THE COSTLY IMPACTS OF PREDATION AND CONFLICTING FEDERAL STATUTES ON NATIVE AND ENDANGERED FISH SPECIES

OVERSIGHT HEARING

BEFORE THE

SUBCOMMITTEE ON WATER, POWER AND OCEANS

OF THE

COMMITTEE ON NATURAL RESOURCES
U.S. HOUSE OF REPRESENTATIVES

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OVERSIGHT HEARING ON THE COSTLY IMPACTS OF PREDATION AND CONFLICTING FEDERAL STATUTES ON NATIVE AND ENDANGERED FISH SPECIES

Wednesday, February 10, 2016
U.S. House of Representatives
Subcommittee on Water, Power and Oceans
Committee on Natural Resources
Washington, DC

The subcommittee met, pursuant to notice, at 10:03 a.m., in room 1334, Longworth House Office Building, Hon. John Fleming [Chairman of the Subcommittee] presiding.

Present: Representatives Fleming, Lummis, Gosar, LaMalfa, Denham, Newhouse; Huffman, Costa, and Lowenthal.

Dr. FLEMING. The Subcommittee on Water, Power and Oceans will come to order. The Water, Power and Oceans Subcommittee meets today to hear testimony on an oversight hearing entitled, "The Costly Impacts of Predation and Conflicting Federal Statutes on Native and Endangered Fish Species."

We will begin with opening statements, and I yield to myself for just that.

STATEMENT OF THE HON. JOHN FLEMING, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF LOUISIANA

Dr. FLEMING. The focus of today's hearing is about simultaneously protecting the American taxpayer and the electricity ratepayer, enhancing self-sustaining tribal economies and coastal economies, and stabilizing food prices.

There are numerous so-called 'stressors' on native and endangered fisheries, but predation by sea lions, birds, and other fish has become a growing problem that outweighs all other stressors in some circumstances. Yet, reducing this stressor should be the lowest hanging fruit to pick, if the Federal Government had its act together. Shockingly, it doesn't.

Billions of ratepayer and taxpayer dollars have been spent to recover endangered fish species on the West Coast and elsewhere. Some measures are working. For example, on average, over 95 percent of salmon migrating through the Pacific Northwest's Federal Columbia River system successfully pass through and over the dams. Electricity ratepayers have invested significantly in this endeavor, with over a third of their monthly bills accounting for migrating salmon costs each year.

But, to add insult to injury, as we will hear later today, sea lions decimate up to 45 percent of the returning Chinook salmon run, and birds eat up to 20 percent of the entire out-migration of juvenile salmon each year. Those sea lions and birds are protected by other Federal statues—namely, the Marine Mammal Protection Act

and the Migratory Bird Treaty Act. So, once again, we have another example of how the right and the left arms of the Federal Government are acting opposite of each other.

Further down in California, where the eyes of the Nation have focused on a crippling drought, Federal and state water supply restrictions have been imposed to help protect the 3-inch Delta smelt and salmon. There are numerous factors that harm the fish, but predation has helped keep these fish on the Federal Endangered Species Act list, and the regulations that go with this listing.

These regulatory measures have exacerbated a natural drought, and the end result has been skyrocketing unemployment up to 40 percent. In the meantime, third-party litigation against measures to control these predators continues. Louisianans are paying not only for this litigation, but for the higher food prices associated with California's fruits, nuts, and vegetables.

The Federal Government can do better, starting with enacting bipartisan legislation introduced by our colleagues, Jamie Herrera Beutler and Kurt Schrader, to control more sea lions. More administrative things can be accomplished, too, beginning with what our tribal witness says is a "metric for fish, bird, and marine mammal predation, so the comparisons and impacts can be properly assessed."

The status quo may be working for sea lions and litigators, but it is not working for the American taxpayer, the electricity ratepayer, fisheries, tribal communities who have worked hard to bring back salmon populations, and our food consumers nationwide. Today's hearing is another step toward much-needed change.

[The prepared statement of Dr. Fleming follows:]

PREPARED STATEMENT OF THE HON. JOHN FLEMING, CHAIRMAN, SUBCOMMITTEE ON WATER, POWER AND OCEANS

The focus of today's hearing is about simultaneously protecting the American taxpayer and the electricity ratepayer, enhancing self-sustaining tribal economies and coastal economies and stabilizing food prices.

There are numerous so-called "stressors" on native and endangered fisheries, but predation by sea lions, birds, and other fish has become a growing problem that outweighs all other stressors in some circumstances. Yet, reducing this stressor could be the lowest hanging fruit to pick if the Federal Government had its act together. Shockingly, it doesn't.

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The status quo may be working for sea lions and litigators, but it is not working for the American taxpayer, the electricity ratepayer, fisheries, tribal communities who have worked hard to bring back salmon populations and our food consumers nationwide. Today's hearing is another step toward much-needed change.

Dr. FLEMING. The Chair would like to recognize the Ranking Member, Mr. Huffman.

STATEMENT OF THE HON. JARED HUFFMAN, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF CALIFORNIA

Mr. HUFFMAN. Thank you, Mr. Chairman, and thanks to our visitors today. I have to say I really do enjoy the opportunities that we have to have substantive discussions about issues affecting our natural resources and our environment. These discussions really remind us just how much we depend on healthy, functioning, resilient ecosystems. We depend on them for food, for clean water, for jobs, revenue, recreation, and for protection from disaster. So, I am very pleased today to have a conversation about these issues, and to discuss how we will work toward the recovery of our native salmon and steelhead.

Now, as the Chairman knows, many of our salmon and steelhead runs are not doing so well. I am sorry to say that in California we have what can only be described as a salmon crisis. According to some estimates, 78 percent of our California native salmon may be extinct or extirpated within the next century if the current trends continue.

In 2008 and 2009, we had the first-ever total closure of the ocean salmon fishery along the West Coast because of the poor returns in California. A closure like that absolutely devastates the fishing industry. It results in significant job losses. And, ultimately, closures like that require millions of dollars in disaster aid from Congress. Sadly, what happened in 2008 and 2009 may only be a preview of our future if we continue on with business as usual.

While I appreciate the focus of today's hearing is on predation, it is important to recognize there are many other important stressors, much greater stressors, that have to also be discussed and addressed before our salmon and steelhead stocks will recover.

In California, we have unsustainable water exports from the Sacramento-San Joaquin Delta, degraded habitat conditions, an environment where more than 90 percent of the historic spawning habitat for Central Valley salmon and steelhead is blocked by dams, and a lack of sufficient cold water to sustain our fisheries.

Just last week Federal officials announced that we had a 97 percent mortality rate for juvenile Sacramento winter-run salmon in 2015, and that is following similar dismal years each of the prior 2 years. We know this disastrous decline was caused by excessive water withdrawals and faulty temperature readings that allowed water temperatures in the Sacramento River to rise too high for

salmon survival. The year before, juvenile salmon, as I mentioned, had a 95 percent mortality rate. And together, this data suggests that we absolutely have to address the scientifically demonstrated root cause of this problem. We need to do better.

Now, on predation, I think our recovery efforts have to be guided by science. Currently, there is some scientific uncertainty about whether predator removal programs, like the ones supported by my Republican colleagues, actually help or hurt endangered fisheries. But I do agree that the issue is worth examining, and I look forward to hearing from our witnesses.

However, we also have to deal with the other stressors that we know are preventing salmon recovery, even the politically difficult ones, like unsustainable water exports in California. Otherwise, we will never be able to protect the salmon jobs that are so important to my district or to Oregon, Washington, or Alaska. It is also very important to note that predator control problems supported by my Republican colleagues target fish species that are protected and managed very differently under state law.

So I hope, going forward, my Republican colleagues will give some consideration to the fact that it is the state of California and its Fish and Game Commission that decides whether a fish like the striped bass is treated as a nuisance predator that should be fished out of a system, or whether it is prized for its value as a game fish. We are going to have to work together with the state and try to be on the same page.

Similar to California, the Columbia River system is home to 13 ESA-listed salmon and steelhead runs. And we know that the decline of these runs has been caused by the construction and operation of large dams. The Bonneville Power Administration and the Army Corps of Engineers have invested a lot of resources into helping imperiled fish navigate the stagnant pools and massive dams blocking what, in many cases, are severely degraded spawning grounds. But there is still a lot of work to do.

Last year, this committee examined legislation to increase lethal take of California sea lions below Bonneville Dam. There is every reason to believe that simply focusing on that problem will not solve the bigger problem of salmon recovery. It will not solve the problem of the Bonneville buffet created as salmon line up to enter the dam's fish ladders. And it is important to remember the dam created the buffet; the sea lions are just exercising their all-you-can-eat privileges.

Likewise, programs to kill cormorants and Caspian terns are very questionable. A U.S. Fish and Wildlife survey recently found that cormorant predation on juvenile salmon has no impact on the number of adults returning to the river, and therefore, no impact on salmon survival and recovery.

Look, in an ecosystem, lots of living things eat lots of other living things. That is the way nature works. Perhaps we are overdue for a primer on that basic tenet of ecosystems.

But I do look forward to our discussion this morning, Mr. Chairman. And again, I thank the witnesses for their participation.

[The prepared statement of Mr. Huffman follows:]

PREPARED STATEMENT OF THE HON. JARED HUFFMAN, RANKING MEMBER, SUBCOMMITTEE ON WATER, POWER AND OCEANS

Mr. Chairman, I have to say that I really enjoy the opportunity to have substantive discussions about issues affecting our resources and our environment. These discussions remind us just how much we depend on healthy, functioning, resilient ecosystems. We rely on them for food, clean water, jobs, revenue, recreation, and protection from disasters, so I'm pleased to talk today about these issues and to discuss how we'll work toward the recovery of our native salmon and steelhead.

As the Chairman knows, many of our salmon and steelhead runs are not doing well. I'm sorry to say that in California we have what can only be described as a salmon crisis. According to some estimates, 78 percent of California's native salmon will be extinct or extirpated within the next century if current trends continue.

In 2008 and 2009, we had the first ever *total* closure of the ocean salmon fishery along the West Coast because of poor salmon returns from California. The closure devastated the Pacific Coast fishing industry, resulting in significant job losses. Ultimately, the fishing closure required millions of dollars in disaster aid from Congress. Sadly, what happened in 2008 and 2009 is only a preview of our future if we continue on with business as usual.

While I appreciate that the focus of today's hearing is predation, we know that there are many other important stressors that we must address before our salmon and steelhead stocks will recover. In California we have unsustainable water exports from the Sacramento-San Joaquin Delta, degraded habitat conditions, an environment where more than 90 percent of the historical spawning habitat for Central Valley salmon and steelhead is blocked by dams, and a lack of sufficient cold water to sustain our fisheries.

Just last week Federal officials announced that we had a *97 percent mortality rate* for juvenile Sacramento winter-run salmon in 2015. We know that this disastrous decline was caused by excessive water withdrawals and faulty temperature readings that allowed water temperatures in the Sacramento to rise too high for salmon to survive. The year before, juvenile salmon suffered a *95 percent mortality rate*. We must address the scientifically demonstrated root causes of this problem. We must do better.

On predation, I believe our recovery efforts must be guided by the science. Currently, there's some scientific uncertainly about whether predator removal programs like the ones supported by my Republican colleagues actually help or hurt endangered fisheries, but I agree that the issue is worth examining and I look forward to hearing more from our witnesses. But we must also deal with the other stressors that we know are preventing salmon recovery, even the politically difficult ones like unsustainable water exports from the Sacramento-San Joaquin Delta. Otherwise we'll never be able to protect the salmon jobs that are so important to my district, or to Oregon, Washington, or Alaska. It's also important to note that the predator control programs supported by my Republican colleagues target fish species protected under State law. I hope going forward my Republican colleagues will respect the state of California's role in determining species protections.

Similar to California, the Columbia River system is home to 13 ESA-listed salmon and steelhead runs. We know that the decline of these runs has been caused by the construction and operation of the Federal Columbia River Power System, While the Bonneville Power Administration and the Army Corps of Engineers have invested significant resources in helping imperiled fish navigate the stagnant pools and massive dams blocking what are in many cases significantly degraded spawning grounds, there is still much work to be done.

Last year, this committee examined legislation to increase lethal take of California sea lions below Bonneville dam. We know that sea lions are native to this area and have always eaten salmon. While removing a few of them may make some people feel better, and may in the case of identified problem animals have some measurable positive impact, it will not solve the problem of the "Bonneville Buffet" created as salmon line up to enter the dam's fish ladders.

Likewise, programs to kill cormorants and Caspian terns—which have been eating salmon and steelhead in the lower Columbia since long before humans first set foot in North America—will not bring these fish back from the brink of extinction. Indeed, a U.S. Fish and Wildlife Service study found last year that cormorant predation on juvenile salmon has no impact on the number of adults returning to the river, and therefore no impact on salmon survival and recovery.

In an ecosystem, lots of living things eat lots of other living things. That's simply the way nature works. In an ecosystem heavily altered by humans, new conditions often favor some predators over others. Salmon are keystone species, and many other species depend on salmon as part of their diets. They always have and they

always will. This is not something we should lament, and neither is the fact that conservation laws like the Marine Mammal Protection Act and the Migratory Bird Treaty Act have been successful in restoring many of these salmon dependent species. What we should lament is that we have not done enough to deal with the root causes of salmon decline and have not taken the actions necessary to restore fish populations as quickly as we have restored populations of some seabirds and marine mammals.

One action that would have a much more significant impact on salmon and steelhead recovery is the removal of dams that have outlived their useful life spans. I applaud President Obama, Secretary Jewell, Undersecretary Sullivan, the states of California and Oregon, and PacifiCorp for circumventing the roadblocks thrown up by this Republican Congress and beginning the long overdue process of dam removal on the Klamath River. I am hopeful that this is the beginning of a movement to accelerate salmon recovery by focusing on deadbeat dams in the West.

Thank you, I yield back.

Dr. FLEMING. The gentleman yields.

The Chair now recognizes Dr. Gosar for an opening statement.

STATEMENT OF THE HON. PAUL A. GOSAR, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF ARIZONA

Dr. GOSAR. Thank you, Mr. Chairman, and thanks to the witnesses for coming today. The topic of this hearing is very important to Arizonans and others who depend on the Colorado River for their water and power supplies. Most everyone agrees with the need to recover truly endangered species. The questions are over the best ways to accomplish this objective.

As many of us in the West know, the Endangered Species Act is a relatively inflexible Federal law that continues to be driven by litigation. The endangered species costs borne by the American taxpayer and water and electricity ratepayers can be staggering in some cases, but some do not want those costs to be made public or in an understandable form.

That is why I have introduced H.R. 1869, the Environmental Compliance Cost Transparency Act. This bipartisan bill mandates the power marketing administrations, which sell power from our Federal reservoirs, to provide a line item of the environmental costs on their customers' power bills. This allows customers to see exactly what they are paying for, so that they are better informed to what may be working and what may not. Shining the light of sun on government is never a bad thing.

Controlling predators is part of these costs. For example, efforts to control the evasive green sunfish, which devour endangered humpback chub near Lees Ferry, Arizona, are part of hundreds of millions of ratepayer and taxpayer dollars aimed to recovering four endangered fish in parts of the Colorado River Basin.

As we will hear today, we actually have some Federal laws that make it even harder to recover truly endangered species. Perhaps more egregiously, we have an outdated provision in the Federal Central Valley Project Improvement Act that actually has a goal of doubling the invasive striped bass, a voracious predator of endangered salmon smolts.

[Slide]

Dr. GOSAR. Now, if you will take a look up at the screen, there is a picture. In some cases, over 90 percent of the smolts are

devoured by striped bass in parts of central California, making a mockery of fish recovery and taxpayer investments.

Now we are going to look at a video in just a second. This video, while reminiscent of a 1980s video game, shows us how a smolt which has radio telemetry is being chased and devoured by a striped bass which also has a radio. This 2009 Bureau of Reclamation study at the Old and San Joaquin Rivers shows the salmon in red, chased by the striped bass in blue. Let's take a peek.

[Video shown.]

Dr. GOSAR. Yes, you can't make up this contradiction in Federal law. But every time Republicans have tried to strip the striped bass from that list, we are met with statements that the 1992 law is sacrosanct and cannot be touched.

Outdated laws do nothing except line fundraisers' and lawyers' pockets, and prolong a failed status quo. And blaming Federal water and power infrastructure, in the hopes of tearing it down, breaching it, or undermining it, is not only irresponsible, but unrealistic.

We have two witnesses before us today: a tribal representative from the Pacific Northwest and a fish biologist from California, who experience these issues firsthand every day, and see the unnecessary conflicts between our Federal laws. I commend them for their leadership and dedication, and hope that this Administration will finally start to listen.

As Chairman Fleming said in his opening statement, let's pick some low-hanging fruit.

And with that, Mr. Chairman, I yield back. Thank you.

[The prepared statement of Dr. Gosar follows:]

PREPARED STATEMENT OF THE HON. PAUL A. GOSAR, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF ARIZONA

Thank you for holding this hearing. The topic of this hearing is very important to Arizonans and others who depend on the Colorado River for their water and power supplies.

Most everyone agrees with the need to recover truly endangered species. The questions are over the best ways to accomplish this objective. As many of us in the West know, the Endangered Species Act is a relatively inflexible Federal law that continues to be driven by litigation.

The endangered species costs borne by the American taxpayer and water and electricity ratepayers can be staggering in some cases, but some don't want these costs to be made public or in understandable form. That's why I've introduced H.R. 1869, the Environmental Compliance Cost Transparency Act. This bipartisan bill mandates the Power Marketing Administrations, which sell power from our Federal reservoirs, to provide a line item of environmental costs on their customers' power bills. This allows customers to see what exactly they're paying for so they are better informed of what may be working and what may not. Shining the sun on government is never a bad thing.

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This video, while reminiscent of a 1980s video game, shows us how a smolt that has radio telemetry is being chased and devoured by a striped bass which also has a radio (show video).

You can't make up this contradiction in Federal law, but every time Republicans have tried to strip the striped bass from that list, we are met with the statement that the 1992 law is sacrosanct and cannot be touched. Outdated laws do nothing except line fundraisers and lawyers pockets and prolong a failed status quo.

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I look forward to today's hearing. Thank you.

Dr. FLEMING. The gentleman yields. We are ready to hear from our witnesses today. Each witness' testimony will appear in full in the hearing record, so I ask that witnesses keep their oral statement to 5 minutes, as outlined in our invitation letter.

You noticed we went maybe a little bit over our 5 minutes. We set a bad example for you.

[Laughter.]

Dr. FLEMING. We prefer you stay within your 5 minutes.

I also want to explain the timing lights. You will be under a green light for 4 minutes, a yellow light for 1 minute, and, when it turns red, we ask that you conclude your statement. Every word of your statement will be put into the written testimony.

To introduce our witnesses, first we have the Honorable Leotis McCormack, Secretary of the Columbia River Inter-Tribal Fish Commission from Lapwai, Idaho. Am I saying that correctly? Lapwai? OK.

We also have Mr. Will Stelle, Regional Administrator of the West Coast Region for the National Marine Fisheries Service, based in Portland, Oregon; Dr. Gary Grossman, Professor of Animal Ecology with the Warnell School of Forestry and Natural Resources at the University of Georgia in Athens, Georgia; and Mr. Doug Demko, President of FISHBIO in Chico, California.

I now recognize Mr. McCormack for your testimony, sir.

STATEMENT OF THE HON. LEOTIS MCCORMACK, SECRETARY, COLUMBIA RIVER INTER-TRIBAL FISH COMMISSION, LAPWAI, IDAHO

Mr. MCCORMACK. [Speaking native language.] Good morning. Again, my name is Leotis McCormack. I am a Councilman for the Nez Perce Tribe. I also sit as the Secretary for the Columbia River Inter-Tribal Fish Commission (CRITFC). Chairman Fleming and committee members, I want to extend my appreciation for this opportunity to testify before you this morning.

As it stands, there are 13 salmon and steelhead populations in the Columbia Basin listed under the Endangered Species Act. Predation by marine mammals and birds of freshwater fish is one of the largest sources of mortality upon juvenile and adult salmon alike. There is a regional consensus that predation is and will be a priority issue to address.

I will briefly describe the three categories of predation, followed by current actions being taken to manage them, then conclude with some recommendations.

First, regarding marine mammals: 20 years ago, Yakima Nation fisherman and tribal leader, Virgil Lewis, was among the first citizens of the Northwest to recognize and call attention to the growing California sea lion problem. There was a huge presence in the lower Columbia River as fish counts, because of the dams, were dropping. The fish that did make it to the fish ladders were often mortally wounded by these sea lions.

Today, it is widely understood that sea lions and other marine mammals are causing serious harm to endangered salmon. CRITFC estimates that over 50,000 ESA-listed spring Chinook salmon have been taken in the Columbia River by California sea lions since the year 2000. The current sea lion population is now greater than 350,000, a six-fold increase since the enactment of the Marine Mammal Protection Act (MMPA). They are growing at a rate of 9.2 percent every single year.

Following a lengthy permitting process, the states of Oregon and Washington are implementing an effective, though limited, lethal removal program. This limited removal program, as it stands, has not and will not keep pace with their growth rate.

We are particularly concerned with the effect this growing sea lion population will have on the lower return years which are being projected. Last session, H.R. 564, the Endangered Salmon and Fisheries Predation Prevention Act was introduced to create more efficiency in dealing with predator sea lions. CRITFC strongly supports that specific legislation.

For predation by avian species: there are over a dozen species of birds in the Columbia Basin whose diet is primarily fish. Annual losses of juveniles are staggering. During 4 recent years of record-keeping from 2010 to 2013, losses ranged from 17–21 million smolts annually by a double-crested cormorant colony on East Sand Island, a man-made island near the mouth of the Columbia River. This equates to approximately 20 percent of the entire out-migration of all juvenile salmonids each year. Caspian terns nesting on that same island consumed an additional 3–5 million smolts annually during that same time period.

The Caspian tern control strategy has been to drive them from areas of high salmon predation to areas of lower impact. However, this process takes years. It is highly unpredictable, and during the transition period, juvenile salmonids continue to be eaten by the millions.

The double-crested cormorant emphasis is on nest destruction and lethal removal of 50 percent of the existing population. We achieved last year's goal of destroying over 5,000 nests and the lethal removal of the approximately 3,500 adult birds. There are 3 years remaining in this effort.

With regard to predation by freshwater fish species: the Columbia River was originally home to fewer than 40 fish species, including salmon. Today the number is close to 80. Half of these fish are not native, and many of them are partially or wholly fish-eating.

For over 20 years, the native northern pikeminnow has been the target of an aggressive bounty campaign to reduce its numbers, generally successfully. However, many non-native fish are given protection as game fish, and managed for sport angling purposes. It is a recipe for disaster for endangered salmon.

In my written testimony, I include several specific management recommendations, which I will summarize here. First, develop a common metric for fish, bird, and marine mammal predation. Second, assess and act quickly when predation trends develop. Third, prioritize salmon management in anadromous waters and remove barriers to harvest of non-native fish species, then emphasize population management, rather than on individual animals. Determine reasonable population ceilings for avian predators, then predatory non-native fishes, and last, reduce, when necessary, overall predator population sizes using all tools, including lethal removal.

How can Congress improve natural resource? They can do that by placing tribes on equal footing as states for access to authorities, permits, and management tools and requiring respectful deference to tribal treaty rights and endangered species when in conflict with non-endangered protected species.

Chairman Fleming and committee members, this hearing gives us hope that Congress will address these contradictions and otherwise well-intended natural resource laws. So again, I want to say [Speaks native language.], thank you from the bottom of my heart for this opportunity to testify before you today. Thank you.

[The prepared statement of Mr. McCormack follows:]

PREPARED STATEMENT OF THE HON. LEOTIS MCCORMACK, NEZ PERCE TRIBE AND COMMISSIONER, COLUMBIA RIVER INTER-TRIBAL FISH COMMISSION

Chairman Fleming, Ranking Member Huffman and distinguished members of the Water, Power and Oceans Subcommittee, on behalf of the Nez Perce Tribe and the Columbia River Inter-Tribal Fish Commission (CRITFC), thank you for inviting me to testify on the costs, impacts and management implications related to the various forms of predation upon native and endangered fish species. My testimony will provide an overview of the three main sources of predation: marine mammals; avian; and freshwater fish, against Columbia River salmon, sturgeon and lamprey. I will offer a brief history of the CRITFC and our legal authorities related to salmon management before discussing successes and challenges managing these forms of predation on Columbia Basin salmonids. My testimony will conclude recommendations for improving predation management.

AN OVERVIEW OF PREDATION ON COLUMBIA RIVER SALMONIDS

Predation is a keystone agent that controls fish population dynamics. Although predation is a naturally occurring population control agent, management becomes necessary in a highly modified environment, such as the Columbia River Basin. Since the implementation of the Tribes' Spirit of the Salmon Plan, an alarming increase in predation of sturgeon juveniles, salmon and lamprey by birds, marine mammals and other fish has occurred (Rieman et al. 1991; Collis et al. 2002; Evans et al. 2012; Stansell et al. 2010). In the basin, newly created habitats from dredge spoils increased predacious bird populations, along with changes to primary food sources bringing more hungry sea lions upriver, the creation of reservoirs and the introduction of predatory species have resulted in ballooning predator populations. The negative changes in avian, mammalian, and fish species population dynamics have tipped the predator/prey balance to the point that active management is required to rebalance predator populations and reduce salmon, lamprey and sturgeon losses.

Avian predation refers to predation by piscivorous (i.e., fish eating) birds on salmonids. Key avian predator species in the Columbia Basin include Double-Crested Cormorants (*Phalacrocorax auritus*), Caspian Terns (*Hydroprogne caspia*), California Gulls (*Larus californicus*), Pelicans and Ring-Billed Gulls (*Larus delawarensis*). The abundance and distribution of double-crested cormorants and Caspian terns has increased dramatically in recent years, from a few hundred to tens of thousands in a less than 20 years (Roby et. al. 2012). In 2011, the combined loss was approximately 23 million salmon smolts (BRNW 2012). Smolts may also be subject to predation by marine seabirds off the Pacific Coast. Estimates of these oceanic predators are upwards of a hundred thousand birds or more (NMFS personal communication).

Marine Mammal predation is a growing problem in the lower Columbia River. California Sea Lion (*Zalophus californianus*) abundance and their impacts on listed salmonids (*Oncorhynchus* spp.) increased dramatically at Bonneville Dam since the turn of the century, stabilized for a couple of years and since 2013 have increased to the highest levels ever recorded. In 2008, the National Marine Fisheries Service granted the states of Oregon, Washington, and Idaho authority to lethally remove nuisance California sea lions under section 120 of the Marine Mammal Protection Act (MMPA). CRITFC estimates that over 50,000 ESA-listed spring Chinook salmon have been taken in the Columbia River by California sea lions since the year 2000. Since 2009, Steller sea lion (*Eumetopias jubatus*) abundance in the Columbia River has also increased. In 2012, Steller sea lion predation at Bonneville Dam actually exceeded that of California sea lions. However by 2015, California sea lions were again the dominate species at Bonneville Dam and they teamed with Steller sea lions to take approximately 8,500 salmon and steelhead. Bear in mind that this take was observed within ¼ mile of Bonneville Dam and represents only an index of predation since sea lions were distributed throughout the river from the Dam to the estuary (about 150 miles). In 2015, 2,340 sea lions were counted at the East Mooring Basin on March 20, in Astoria, OR near the mouth of the Columbia River. Abundance of sea lions using the East Mooring Basin in 2013 was about 700, this number approximately doubled in 2014, and doubled again in 2015. California sea lion abundance was estimated at 296,750 animals in 2010 (Carretta et al. 2011) indicating that the population is robust and expanding. California sea lions are present year round in Bonneville Dam's reservoir.

Fish predation (i.e., fish on fish predation) is well studied or barely studied, depending on the species of predator. Baseline research efforts in the John Day reservoir on the Columbia River in the 1980s identified a native fish, the Northern Pikeminnow (*Ptychocheilus oregonensis*), as a significant predator of salmonid smolts, along with non-native walleye, smallmouth bass and channel catfish (Vigg et al. 1991). Estimates of smolt predation were in the millions, with most eaten by northern pikeminnows, which are not protected as a game fish by the states of Oregon and Washington. An intensive government sponsored public control program on northern pikeminnows was initiated in 1990 and continues to this day. The program has removed nearly 4 million pikeminnow from the Columbia and Snake Rivers. Management action to remove non-native piscivorous fishes has not been taken, although sufficient information confirms their direct and indirect impacts to salmon (ISAB 2008). In 2013, Washington State removed the size and daily limits on catfish, walleye and smallmouth bass on selected areas of the Columbia and Snake River and their tributaries upstream of McNary Dam. In 2015, the state of Oregon enacted similar regulation for the mainstem Columbia from the Pacific Ocean upstream to the state boundary with Washington upstream of McNary Dam. However, major salmon bearing tributaries such as the Willamette, Hood River, John Day River, and the Umatilla still have restrictive regulations that protect largemouth and smallmouth bass, also known predators of juvenile salmon and lamprey. Similarly, portions of the Snake River in Oregon have bag and possession restrictions to protect largemouth and smallmouth bass

COMMISSION HISTORY AND LEGAL AUTHORITIES

The Columbia River Inter-Tribal Fish Commission was formed in 1977 by resolutions from the four Columbia River treaty tribes: Confederated Tribes of the Umatilla Indian Reservation, Confederated Tribes of the Warm Springs Reservation of Oregon, Confederated Tribes and Bands of the Yakama Nation, and Nez Perce Tribe. CRITFC's mission is to ensure a unified voice in the overall management of the fishery resource and to assist in protecting reserved treaty rights through the exercise of the inherent sovereign powers of the tribes. CRITFC provides coordination and technical assistance to the tribes in regional, national and international efforts to ensure that outstanding treaty fishing rights issues are resolved in a way

that guarantees the continuation and restoration of our tribal fisheries into perpetuity.

The combined ancestral homelands of our four tribes cover roughly one-third of the entire Columbia River Basin in Washington, Oregon, and Idaho. Our existence on the Columbia River stretches beyond 10,000 years to time immemorial. Salmon has always been a unifying force and we rely on its abundance for physical and cultural sustenance. Collectively, we gathered at places like Celilo Falls to share in the harvest, forging alliances that exist today. Our fishing practices were disciplined and designed to ensure that the salmon resource was protected, and even worshipped, so it would always flourish.

Salmon is so fundamental to our society that in 1855 when our four sovereign tribes [1] and the United States collaborated and negotiated treaties, our tribal leaders explicitly reserved—and the United States agreed to assure—our right to fish in perpetuity within our ancestral homelands as well as to "take fish at all usual and accustomed places." We kept our word by ceding roughly 40 million acres of our homelands to the United States, while the United States pledged to honor our ancestral rights. It was the expectation of our treaty negotiators then that we would always have access to abundant runs of salmon; it is our expectation now that the U.S. Government will honor that commitment and take the steps necessary to protect our treaty resources. The treaties of 1855 were all ratified by the Senate of the United States. The Supremacy Clause of the Constitution applies to all such treaties.

The importance of fish, especially salmon, to our tribes cannot be overstated. In *U.S. v. Winans*, the U.S. Supreme Court stated that fishing was "not much less necessary to the existence of the Indians than the atmosphere they breathed." The salmon are an integral part of our cultural, economic and spiritual well-being. They are a primary food source and our consumption of this First Food is nearly 10 times higher than the national average. Salmon is fundamental to a healthy tribal diet and plays a significant role in combating the risks of heart disease and diabetes in our communities.

Our livelihood evolved over thousands of years and our physical and cultural survival was intimately tied to the salmon. Ceremony became essential to insure the continued survival of the salmon, our traditions, and thus ourselves. Without salmon and without ceremony, we would cease being Indian people. We are longhouse people and these ceremonies have gone on without interruption for thousands of years. For these reasons, in conjunction with modern fisheries management principles, we are alarmed over the increasing impact by sea lions and other predators on these vital treaty and public resources.

A BRIEF HISTORY OF SALMON DECLINE

The Columbia Basin and its tributaries began seeing major changes in the 1800s as agricultural lands were developed and dams harnessed the natural flows to build a western economy with low cost electrical power, navigation, and irrigation. Commercial fishing lacked restraint decimating salmon runs without regard for future generations. Logging, mining and agriculture bit into the earth, fouling clean waters, and degrading riparian habitat crucial to salmon survival. Nature's bounties were exploited to build bigger cities with bigger economies, and the energy and infrastructure to support them was siphoned from the river. As more lands were flooded, more promises flowed. Tribal leaders were told the dams would actually make life easier on salmon as the roaring pace of the river was reduced. We were also told that if any impacts occurred they would be mitigated.

The mitigation and recovery of our treaty fishing resources has been slow but methodical. Thirteen salmon and steelhead populations in the Columbia Basin are listed under the Endangered Species Act (ESA). Pacific lamprey and white sturgeon populations are also depressed and resources to rebuild them are slim, making us worry if they too will be listed under ESA.

REGIONAL RECOVERY EFFORTS

We have been doing our best to bring the salmon back. Our tribal members have long shouldered a heavy conservation burden through voluntary harvest reductions on our fishery. Now, in cooperation with states, Federal agencies, and our neighbors in the Columbia Basin we are making huge financial and social investments in recovery efforts.

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[1] Treaty with the Yakama Tribe, June 9, 1855, 12 Stat. 951; Treaty with the Tribes of Middle Oregon, June 25, 1855, 12 Stat. 963; Treaty with the Umatilla Tribe, June 9, 1855, 12 Stat. 945; Treaty with the Nez Perce Tribe, June 11, 1855, 12 Stat. 957.

In 2008, CRITFC and its member tribes successfully concluded lengthy negotiations resulting in three landmark agreements: (1) the Columbia Basin Fish Accords[2] with Federal action agencies overseeing the Federal hydro system in the Columbia Basin; (2) a 10-Year Fisheries Management Plan with Federal, tribal and state parties under *U.S. v. OR*; and (3) a new Chinook Chapter of the Pacific Salmon Treaty.[3] These agreements establish regional and international commitments on harvest and fish production efforts, commitments to critical investments in habitat restoration, and resolving contentious issues by seeking balance of the many demands within the Columbia River Basin.

IMPACTS OF PREDATION ON TRIBAL FAMILIES

Salmon are central to the ceremonial, subsistence and commercial lives of our people. Salmon fishing has long been a traditional way of providing the necessary means to safeguard our families economically. Even the settlers who descended upon our ancestral homelands capitalized on the abundant salmon runs to secure an economic foothold in the region. In the middle of the 1900s, spring salmon runs dwindled and we had to forgo a tribal commercial harvest. However, when runs rebounded slightly from 2000 to the present we were able to open limited commercial tribal harvests.

A commercial tribal fishery diversifies economic opportunities in what are traditionally hard hit rural economies. We have made considerable investments to rebuild our salmon economy and increase the commercial value of tribally caught salmon. Not long ago, the tribal commercial fishermen were receiving 30 to 40 percent less than market value. Today, we have overcome this disparity through innovative marketing strategies, individual training and public outreach. It has taken several years to build a brand identity for tribally caught salmon. The public is embracing the benefits of buying the products of our tribal fishery and demand is outpacing supply.

Predation is most notable and alarming to tribal communities in the spring when spring Chinook, the mainstay of our salmon culture, is exploited by marine mammals in the lower Columbia and especially at migratory bottlenecks, such as passage points at dams. Prized for ceremonial, subsistence and commercial uses, these important uses have all suffered from predation's impact. Some fish buyers won't purchase damaged fish and the value can drop as much as 50 percent. The growing level of sea lion predation can devastate the hard earned the value of the tribal commercial fishery.

Impacts by predation to juvenile salmon, while sometimes less visible, are no less harmful to tribal families by the alarming numbers of juvenile salmon killed.

MARINE MAMMALS—A GROWING MANAGEMENT CONCERN

California Sea Lions, Steller sea lions and other marine mammals historically had a very limited presence in the Columbia River with a functional and mutually respectful relationship between them and tribal people. Tribal members harvested them for their skins and oils. Tribal members also killed marine mammals that were disruptive to fishing activities. Though well intentioned, the MMPA has made the river more hospitable to opportunistic sea lions and less hospitable to salmon, lamprey and sturgeon survival by limiting traditional and modern management methods. The sea lions have learned to profit from the abnormal situation by preying on salmon and other treaty protected resources particularly at vulnerable areas like Bonneville Dam. They are cunning, proven by their ability to outmaneuver the exclusion devices placed in the fish ladders and their ability to ride the shipping barges through the dam's locks. While we admit that the Creator intended a place for them, it doesn't lessen the problem they are causing by exploiting an unnatural environment.

There was a time when a portion of a state fishing license fees were used to manage the sea lion population to reduce their predation. Historically, when sea lions made it up to those parts of the river where the dams now sit, they would be shot and they would be bled out in the river. Sea lions were shrewd enough to understand that this was an area they needed to avoid. Things have changed for the worse now because man has changed the nature of the river. Now, returning salmon must pass artificial dams and go up man-made cement fish ladders to get upstream. They are trapped by sea lions who understand the salmon must go right by them if they hang out close to the ladders. We ask our friends in the animal rights

[2] The Nez Perce Tribe is not a Columbia Basin Fish Accord signatory.
[3] *See* "Salmon Win A Triple Crown" at http://www.critfc.org/text/wana_w09.pdf.

community to understand that we are dealing with basic nature when the ability of endangered salmon to defend themselves has been so compromised.

Some people claim that placing blame on the sea lions is a ruse to divert attention away from the dams' impact on salmon survival. If they understood our dilemma, they would clearly recognize that attention is actually being drawn to Bonneville Dam where a growing number of sea lions have learned to exploit an artificial situation to disproportionately impact depressed salmon runs. Increasing numbers of sea lions have been documented returning year after year. In the last 5 years, over a hundred animals have learned to prey on threatened and endangered spring Chinook as they converge on the entrances to the dam's fish ladder.

Significant predation at the dam is rising, evidenced by the number of salmonids eaten by sea lions. But growing data sets paint a troubling picture of increasing depredation throughout the lower Columbia River. We have previously estimated that 18 percent to 25 percent of the spring Chinook salmon run are lost to sea lions annually between Bonneville Dam and the mouth of the river, but based on recent NOAA research, it could be as high as 45 percent of the run. In addition, impacts by sea lions are disproportionally distributed on the early portion of the run. During March and April there are many days when the take by sea lions exceeds the fish count in the ladders. We are concerned that these early returning fish may be from stocks that are most at risk of extinction.

Every year a few sea lions pass through the Bonneville Dam lock. These animals damage fishing gear and steal salmon from our fishers. Some California sea lions have spent over 4 years in the Bonneville pool. Studies show that the farther upstream the sea lions travel, the higher percentage of salmon and steelhead in their diet. Additional studies indicate that salmon comprise 10–30 percent of their diet. The latest available sampling data beginning in 2001, shows that each year slightly over 30 percent of the spring salmon passing though Bonneville's fish ladder have suffered some form of injury caused by marine mammals. Those salmon that escape with harsh wounds are less likely to survive their upstream journey and unlikely to successfully spawn. Tribal and non-tribal fishermen who harvest these injured fish cannot fully utilize them for their subsistence, sport and commercial value.

Facts on Marine Mammal Predation in the Columbia River:

- An unprecedented explosion of pinnipeds in the lower Columbia River has caused spikes in predation levels of salmon despite years of hazing and cumbersome removal authority;
- California sea lions are completely recovered and expanding, current population estimate is >325,000 with an annual growth rate of 9.2 percent;
- The large and growing surplus of male Sea lions, far in excess of the reproductive needs of the population, is expanding their range in reaction to increasing salmon and smelt runs;
- Sea lions killed over 8,474 salmon within ¼ mile of Bonneville Dam (146 miles from the Ocean) in 2015, a staggering 140 percent increase over the previous 12-year average;
- California Sea Lions have routinely passed through the locks into the Bonneville Pool, 146 miles from the mouth of the Columbia, some residing there for over 4 years;
- The aggressive feeding behavior threatens the safety of sport, commercial and tribal fishermen trying to land catch;
- NOAA Fisheries estimated an unaccounted for loss of 45 percent (99,000 fish) of the 2014 Spring Chinook Salmon run between the estuary and Bonneville Dam, this loss is over four times greater than in 2010 when the losses were estimated at only 10 percent;
- Tribal ceremonial, subsistence and commercial fisheries experience unique and unmitigated damage from growing sea lion predation; and
- Anticipated downturns in future salmon runs due to the present drought conditions would increase sea lion impacts even more. Management tools are needed now to help address this anticipated impact and attempts to address California Sea Lion predation under the existing constraints of the MMPA have been inadequate and hampered by protracted litigation by special interests exploiting ambiguities in the law.

AVIAN PREDATION

Juvenile salmonids and juvenile lamprey in the Columbia River Basin are subject to extensive predation by fish eating (i.e. piscivorous) birds throughout their entire migration route. In the Basin, there are over a dozen species of birds whose diet is primarily fish, but the key predators are double-crested cormorants, Caspian terns, several gull species, and in some areas, white pelicans. Birds are predators on juvenile salmonids and juvenile lamprey during the entire course of the out-migration, but dam tailraces and the estuary are the areas of greatest impact. Annual losses in the estuary are staggering. During the last 4 years of record keeping (2010, 2011, 2012 and 2013), losses ranged from 17 to 21 million smolts annually by a double-crested cormorant colony on East Sand Island, near the mouth of the Columbia River. This equates to approximately 20 percent of the entire out-migration of all juvenile salmonids each year. Many of these fish are wild and are listed as threatened or endangered under ESA.

Additionally, Caspian terns nesting on the same island, also consumed an additional 3–5 million smolts annually during the same time period. Ironically, both of these colonies are the largest for their species in the entire world. Both species are common, with the Caspian tern found throughout the world, while the double-crested cormorants is a North American species with numbers in the hundreds of thousands. Smaller colonies of double-crested cormorants, gulls and Caspian terns nest upstream and eat well over an additional million smolts annually, but with a greater per capita impact. For example, a small colony (<300 pairs) of Caspian terns that nested on Goose Island in Potholes Reservoir, annually consumed approximately 10–15 percent of the entire upper Columbia River juvenile steelhead out-migration.

Management actions have initiated on Caspian terns and double-crested cormorants. Populations of Caspian terns in the estuary and inland have been the focus of habitat alterations and reductions, but with limited success. The focus has been to "push" them from areas of high salmonid predation to areas of lower impacts. However, this process takes years, is highly unpredictable and during the transition period, juvenile salmonids continue to be eaten by the millions.

A different strategy has been implemented on the East Sand Island double-crested cormorant population. Following an exhaustive environmental review, the preferred alternative is nest destruction and lethal removal of ~50 percent of the existing population. Legal challenges followed the approval of the preferred alternative, but did not prevent the initial year of management efforts, which achieved that years' goal of destroying over 5,000 nests and the lethal removal of approximately 3,500 adult birds. There are 3 years remaining in this effort. Subsequent management actions will be necessary to maintain the population at this level, which unfortunately will still continue to eat millions of juvenile salmon each year, but likely less than the tens of millions that were eaten prior to management actions. Additional efforts will be necessary to provide a more balanced and safe environment for migrating juvenile salmonids and lamprey.

PREDATION BY FRESHWATER FISH SPECIES

Historically, the Columbia River Basin fish fauna was composed of salmon, small minnow species, small sculpins, burbot, sturgeon, and several species of lamprey, less than 40 species total. Piscivorous fish were limited to white sturgeon, northern pikeminnow and burbot. Today, the number of fish species in the basin is close to 80 species, ~ half of these fish are not native and many of these species are partially or wholly piscivorous. Some early studies showed that the native northern pikeminnow was the primary fish predator of juvenile salmon. Consequently, an aggressive campaign to reduce the numbers of this native fish has been ongoing for over 20 years. However, many of the non-native fish including largemouth and smallmouth bass, walleye, channel catfish, yellow perch, and crappies are primarily fish predators, but are given protection as gamefish and managed to maximize their populations for sport angling purposes. Given their numbers and distribution throughout the Columbia and Snake Rivers and most major tributaries, this is cause for concern, given that initial research show the propensity of these species to eat juvenile salmon and lamprey. Like predation by pinnipeds and birds, predaceous fishes, particularly introduced species this needs greater focus and management and now is the time to initiate such efforts.

HAZING AND OTHER NON-LETHAL ACTIONS—NECESSARY BUT INSUFFICIENT

Necessary but insufficient measures that are required to protect one species can be very detrimental at protecting other equally important resources. The MMPA

and the MBTA, were created to protect marine mammals and birds from unregulated persecution and in some cases, extinction. However, given the rebound in many populations of these predators, the use of hazing and other non-lethal measures is insufficient to protect other resources. It certain instances, hazing and other non-lethal measures can be effective if the predators being hazed have a similarly productive habitat (i.e. food, nesting or living space) available. However, in many cases habitat is already limited and protected populations of predators continue to expand, there are no alternative habitats available. In these cases much time, money, studies, and other resources can used as a way to avoid lethal removal, with no measurable success. In such instances, lethal removal is not preferred but maybe a necessity to alleviate predation impacts on salmon, lamprey, sturgeon and other important resources. There is a finite amount of habitat and other resources and if predatory populations are not maintained at a fixed level, then prey species will suffer. Therefore, it is appropriate to reconsider the extent of how long non-lethal measures can be exercised before lethal measures can be implemented to protect other resources.

Since 2005, CRITFC, along with Washington and Oregon, have tried dispersing sea lions from the sensitive area immediately below Bonneville Dam through daytime hazing from boats. Our actions have been limited to a 5-mile zone just downstream from the dam and not the entire 150 river miles from the dam to the Pacific Ocean. Non-lethal hazing has a very short-term effect at best. After the crew is done for the day the sea lions move back into the prime feeding positions. Hazing is difficult and risky due to daylight-only limitations and frequent hazardous water conditions. Even under ideal conditions hazing alone is inadequate to remedy the predation problem.

We do recognize that some animals respond to hazing better than others and that it will remain a component of any future robust management package. CRITFC and tribal crews wish to continue implementing hazing functions, as well as estimating sea lion abundance in the lower river. We are also collaborating with the states to develop techniques that may in future be useful for estimating sea lion predation rates in the lower Columbia River. Initially CRITFC diverted a portion of our Bureau of Indian Affairs funding to pay for our hazing efforts, however Bonneville Power Administration has funded our hazing efforts since 2007.

JUSTIFICATION OF SUPPORT FOR CONGRESSIONAL ACTION TO IMPROVE PREDATION MANAGEMENT

We should not be forced to stand back as sea lions, birds, and non-native fishes cause other species, such as salmon, steelhead sturgeon and lamprey, to decline or even become listed under ESA. Specific actions by Congress related to the MMPA and the Migratory Bird Act could assist co-managers, including our tribes, strike a better balance between species interactions, especially in altered ecosystems.

Such actions could:

1. Place tribes on equal footing as states for access to authorities, permits and management tools;
2. Emphasize population management rather than individual animals;
3. Provide clear and respectful deference to Endangered Species when in conflict with non-endangered or Protected Species;
4. Provide clear and respectful deference to tribal treaty protected species;
5. Provide emergency exemptions to the National Environmental Policy Act; and
6. Require the Secretaries of Commerce and Interior to provide reports on predation on ESA listed and treaty protected species.

We do not take exemptions to the National Environmental Protection Act lightly. However, short-term, emergency-based exemptions focused exclusively on managing the most aggressive and severe predation circumstances may be necessary and sound. Such exemption may be necessary to give the fishery managers the ability to respond swiftly to avoid extraordinary delay that puts the species, our investments, and our livelihood at risk.

We are appreciative that H.R. 564, currently being considered in the House of Representatives, designates each of our four member tribes as eligible entities for MMPA permitting, and identifies the Columbia River Inter-Tribal Fish Commission as an eligible entity to delegate permit authority. This is good and appropriate as our tribes are very capable, professional fishery managers with the necessary skills to administer and implement the provisions of a permit.

There are provisions for de-listing species under the ESA—something we all aspire to achieve with salmon. The same consideration should be given to bird and

marine mammal species who have achieved their optimum sustainable populations as provided under their protecting laws. MMPA is overdue for reauthorization and we urge Congress and the Administration to take this matter up and reconcile the disparity of one species being caught in the middle when two environmental protection laws clash.

If we continue to use the same insufficient measures we are using today, it will be difficult to answer to the region, ratepayers, taxpayers and the region's fishermen, who have invested in salmon restoration across the Columbia Basin.

RECOMMENDATIONS FOR EFFECTIVE COMPREHENSIVE PREDATION MANAGEMENT

Active management can keep predators at levels more in balance with the environment and reduce losses of Columbia River salmon and other native fish populations.

Management efforts can be aided by the following:

- Develop a common metric for fish, bird and marine mammal predation (i.e., adult equivalents) so that comparisons and impacts can be properly assessed;
- Investigate, monitor, evaluate and propose solutions to habitat changes at Columbia River tributary confluences where hydrologic modifications have resulted in increased sediment deposition and potentially attracted predator responses;
- Investigate indirect food web effects of predation;
- Apply active, adaptive management practices to predation sources;
- Persuade co-managers to prioritize salmon management in anadromous waters and remove barriers to harvest of non-native fish species;
- Recognize the benefits of native fish communities and balanced ecosystems;
- Develop greater cross-agency cooperation and investigation opportunities;
- Place greater emphasis on seasonal mainstem and tributary-based predation research and management of predatory non-native fishes and avian predators, particularly during the spring out-migration period;
- Include "several gull species, mergansers, and pelicans" to the list of bird predators and include upstream and tributary areas;
- Support regional efforts by actions agencies to actively manage populations of double crested cormorants and other piscivorous birds with lethal control if habitat modifications and dissuasion efforts are not successful in the Columbia River estuary, as well as inland reaches of the Basin to reduce losses of juvenile anadromous salmonids; and
- Work with co-managers to determine reasonable population ceilings for piscivorous waterbirds and predatory non-native fishes and reduce overall population sizes, including lethal removal for all fish-eating birds and non-native fishes that persist in boat restricted zones, hatchery release points, low head irrigation diversion, tributaries, overwintering habitat, and other areas where temporal and species constraints bring juvenile salmon and lamprey into proximity with predacious species.

In conclusion, the United States made many promises beginning in 1855 with our treaties and subsequently when the dams were constructed. The treaty rights are meant to preserve our physical, cultural and economic livelihood—the United States committed to protecting these rights. We were further promised that any harm done to our fisheries attributed to the dams would be taken care of—Bonneville Dam has created an artificial situation the sea lions have learned to exploit. We have run out of options and any new technology will not be available in the near future to deal with the current dilemma.

We need a full suite of authorities and tools to deal with growing depredation from marine mammals, growing bird colonies and freshwater fish. We need timely solutions to protect our ceremonial, subsistence and commercial harvests for salmon, lamprey and sturgeon.

Again, thank you for this opportunity to share our concerns and to express our support for this legislation.

Dr. FLEMING. OK, thank you, Mr. McCormack. Next up is Mr. Stelle.

You are recognized for 5 minutes, sir.

STATEMENT OF WILL STELLE, REGIONAL ADMINISTRATOR, WEST COAST REGION, NATIONAL MARINE FISHERIES SERVICE, PORTLAND, OREGON

Mr. STELLE. Thank you, Mr. Chairman, Ranking Member, and members of the committee. My name is William Stelle, and I am the Regional Administrator for NOAA Fisheries on the West Coast. It is nice to be back here. I have a written statement, which I would like to submit for the record, and I will try to be disciplined and summarize my oral remarks quickly. Let me offer several general observations, and then a little bit of a sketch of current efforts on predation.

First, is predation a problem with the conservation and recovery of listed salmonids on the West Coast? The answer is yes, unequivocally. And we would welcome the opportunity to work with you and your staff in fashioning legislative strategies to strengthen our efforts to address the predation problems.

Two, context matters a lot. So, if you think that predation is the silver bullet, think again. It is not. It is one factor of numerous factors, what we call limiting factors, for the rebuilding of these salmonid runs. But it is only one. So, just as we address it, we must also address the other factors, as well.

The third major point is science matters. What do I mean by that? What I mean by that is, at the end of the day there are different opinions about whether or not and how to address predation problems, like other things in life. And as we engage the effort to control predation, we must do so based upon data, quantitative data if possible, so that we can demonstrate the character of the problem, we can quantify the problem, and we are also prepared to demonstrate whether or not and to what extent control measures are working or not working. So, science matters, investing in the science infrastructure to enable success is really important.

Then, my final comment would be understand that partnerships in this effort are also essential. This is not just a National Marine Fisheries thing. The states are deeply involved, other Federal agencies are deeply involved, tribes are deeply involved, and the private sector is deeply involved. Building and fostering the partnerships for success in predation control programs is essential.

Let me just sketch a little bit of the predation efforts underway right now, and we can delve into more details during questions.

First of all, as Leo just outlined to you, in the Columbia Basin predation of lots of different sources is a major problem. Bird predation, fish predation, and marine mammal sea lion predation, all three are significant sources, and are outlined in our recovery plans as major limiting factors. And we, working with the Corps of Engineers, the Bureau of Reclamation, the tribes, and the states of Washington, Oregon, and Idaho, are instituting programs to address avian predation, fish predation, and sea lion predation.

On sea lions in particular, we would welcome working with the committee on ways to strengthen, streamline, and broaden the management measures that we can bring to bear to manage these burgeoning sea lion populations. It is a real problem.

Moving to the south, into the Central Valley—also of keen interest to members of this committee—again, predation is a major problem. Striped bass predation is a major problem. We would wel-

come efforts with the California Department of Fish and Wildlife, the Bureau of Reclamation, and the California Department of Water Resources, to develop the data on the scope and extent of the predation problem, to identify the hot spots of where predation is most likely occurring, and then to implement measures to reduce striped bass prey in those hot spots.

So, we are open and welcome to efforts to pursue and strengthen predation control programs where they occur, on a scientific basis.

With that, I will welcome your questions.

[The prepared statement of Mr. Stelle follows:]

PREPARED STATEMENT OF WILL STELLE, REGIONAL ADMINISTRATOR, WEST COAST REGION, NATIONAL MARINE FISHERIES SERVICE, NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, U.S. DEPARTMENT OF COMMERCE

INTRODUCTION

Good morning Chairman Fleming, Ranking Member Huffman, and members of the subcommittee. My name is Will Stelle, and I am the Regional Administrator for the West Coast Region of the National Marine Fisheries Service (NMFS) at the National Oceanic and Atmospheric Administration (NOAA), within the U.S. Department of Commerce. Thank you for inviting NMFS to testify before you today on predation of Pacific salmon on the West Coast.

The West Coast Region of NMFS is responsible for the stewardship of our Nation's living marine resources and their habitats off the coasts and in the watersheds of Washington, Oregon, California, and Idaho. These responsibilities cover 317,690 square miles of the eastern Pacific Ocean's California Current Ecosystem, over 7,000 miles of tidal coastline, and 176,000 acres of freshwater and estuarine habitats.

The management priority of the West Coast Region is two-fold: to maximize productivity and sustainability of fisheries and fishing communities through effective fisheries management and to recover and conserve protected species and their habitats. The responsibility of the Region, and the agency, to protect, conserve, and recover the Pacific's threatened and endangered anadromous and marine species is found in our authorities under the U.S. Endangered Species Act (ESA) and the Marine Mammal Protection Act (MMPA).

Congress passed the ESA on December 28, 1973, recognizing that the natural heritage of the United States was of "aesthetic, ecological, educational, recreational, and scientific value to our Nation and its people." It was understood that, without protection, many of our Nation's living resources would become extinct. NMFS has ESA jurisdiction over marine and anadromous species, including West Coast salmon and steelhead. Under the ESA, our responsibilities include reviewing species' status to determine if listing is warranted, developing protective regulations to conserve listed species, designating critical habitat to protect the ecosystems upon which the species depend, and developing and implementing recovery plans. These recovery plans serve as a roadmap to bringing threatened and endangered species to the point where ESA protections are no longer needed.

Section 4(a)(1) of the ESA specifies that NMFS shall determine whether a species is threatened or endangered because of any of the following five factors [1]:

1. Present or threatened destruction, modification, or curtailment of its habitat or range;
2. Over-utilization of the species for commercial, recreational, scientific, or educational purposes;
3. Disease or predation;
4. Inadequacy of existing regulatory mechanisms; and
5. Other natural or man-made factors affecting its continued existence.

The complex life cycle of Pacific salmon and steelhead (*Oncorhynchus* sp.) spans freshwater streams and rivers, coastal estuaries, and the great expanse of the California Current ocean ecosystem. This complex life cycle and broad geographic range exposes Pacific salmon and steelhead to a diversity of threats, including those

[1] The ESA further requires that listing determinations be based solely on the best scientific and commercial information available; economic impacts are not considered in making species listing determinations and are prohibited under the ESA.

listed above. Many Pacific salmon and steelhead stocks have declined substantially from their historic numbers and are now at a fraction of their historical abundance. These declines collectively led to NMFS' listing of 28 salmon and steelhead stocks in California, Idaho, Oregon, and Washington under the ESA beginning in 1989.

We have recovery plans currently in place for 19 of the 28 listed salmon and steelhead stocks, and plans for the remaining 9 are proposed or under development. These recovery plans detail the factors leading to the decline and limiting the recovery of each salmon and steelhead stock, and they outline the site-specific actions that are necessary to address each of these threats.

While the specific suite of factors leading to the decline of each salmon and steelhead stock is unique, the list generally includes overfishing, loss and degradation of freshwater and estuarine habitat, hydropower development and blocked passage, poor ocean conditions, and harmful hatchery practices. For some stocks, predation by resurgent pinniped populations, bird colonies, as well as by thriving populations of native and non-native fish species also poses a serious threat to the stock's persistence and eventual recovery.

No single factor holds the key to recovering Pacific salmon and steelhead stocks. Each factor, each threat, must be addressed and reduced. As such, addressing sources of predation is a key component of our strategy to recovering threatened and endangered Pacific salmon and steelhead.

In the past two decades, NMFS has made targeted investments to further understand the effect of predation on various Pacific salmon and steelhead stocks to better inform our recommendations to address this important and emergent threat. We are also executing the statutory and regulatory authorities granted to us under the ESA and the MMPA to take direct action to reduce specific sources of predation. Under section 7 of the ESA, we work with other Federal Action Agencies on projects to operationalize predation control efforts. In these cases, NMFS is able to provide expertise in the design of predator control programs, however, it is the responsibility of the Action Agencies to carry out the programs in adherence with their Biological Opinions (BiOps). NMFS has additionally coordinated with states and local authorities to implement a hazing program under section 109 of the MMPA to discourage depredation of salmon and steelhead by pinniped populations. We have also authorized the lethal removal of individual pinnipeds that have become habituated to predating on salmon at Bonneville Dam in the Columbia River using our authority under section 120 of the MMPA.

The following sections detail a few examples of predation impacts on Pacific salmon and steelhead on the West Coast and NMFS's efforts underway to investigate or mitigate these impacts.

SALMON PREDATION IN THE COLUMBIA RIVER ESTUARY (WASHINGTON/OREGON)

A. Avian Predation Control

NMFS' 2008 BiOp on the Federal Columbia River Power System (FCRPS BiOp) called for the investigation of avian predation in the Columbia Basin by the FCRPS Action Agencies; primarily, the Army Corps of Engineers (Corps). This investigation validated the finding in a Caspian tern plan prepared in 2005 by the U.S. Fish and Wildlife Service, NMFS and the Corps, which showed that Caspian terns were responsible for consuming large numbers of juvenile steelhead and Chinook salmon in the entirety of the Columbia basin. The investigation called for by the 2008 BiOp found that, on average, Caspian terns were consuming more than 5 million salmon and steelhead smolts per year. As a result, the Corps has focused efforts on Caspian terns in its Inland Avian Predator Management plan. Active implementation of the plan began in 2014 with both active and passive dissuasion of terns from nesting at two interior Columbia basin sites that once held up to 850 pairs. Despite the plan's success in its initial year, in 2015, approximately 500 pairs of terns relocated themselves to a third new nesting site due to extremely low Columbia River flows during the 2015 nesting season. NMFS, along with the Action Agencies, expects that higher river flows (and perhaps some active management of reservoir levels) in 2016 will again help reduce the nesting area available at interior Columbia basin nesting sites.

The goal of Action Agencies under the 2008 FCRPS BiOp in the lower Columbia is to manage the tern population by limiting the colony on East Sand Island to 3,125–4,375 nesting pairs in order to increase juvenile Chinook salmon survival by 2 percent and steelhead survival by 3 percent. To accomplish this goal, the Corps has constructed alternate nesting sites in a total of six lake basins in eastern and southern Oregon and in San Francisco Bay to reduce the colony area on East Sand Island to 1.0 acre in size. This reduction led to a relocation of birds to alternate nesting sites outside the Columbia River Basin, yielding a 13 percent reduction in

the number of turn breeding pairs on East Sand Island between 2014 and 2015; however, a large number of non-nesting terns remain in the estuary. NMFS expects that many of these remaining birds will move to the constructed nesting sites outside the basin during 2016 and beyond. A multi-agency Caspian Tern Adaptive Management Team (led by the FCRPS Action Agencies with participation from multiple Federal, state and tribal agencies, including NMFS) is in place to assess the program as it moves forward.

The FCRPS Action Agencies (primarily, the Corps) are also managing double-crested cormorants in the Columbia River estuary under the 2008 FCRPS BiOp to achieve increases in survival of yearling Chinook salmon and steelhead of 1.1 percent and 3.5 percent, respectively. The mechanism to achieve these survival increases has been to reduce the number of cormorants nesting in the estuary from an annual population of 13,500 pairs to an average of 5,380–5,939 nesting pairs. With a depredation permit from the U.S. Fish and Wildlife Service, the Corps began actively reducing cormorant colony size by lethally removing adult birds and oiling eggs in active nests in 2015 after completing their Cormorant Management Environmental Impact Statement (EIS) and Record of Decision. A total of 2,324 adults were culled and 5,089 nests were oiled in 2015 in strict adherence to the EIS' Management Plan. A multi-agency Double-Crested Cormorant Adaptive Management Team (led by the FCRPS Action Agencies with participation from multiple Federal, state and tribal agencies, including NMFS) is in place to assess this program as it moves forward.

In addition to control for these two specific avian predator populations, all mainstem Columbia River dams have monitoring and deterrence plans for avian predators that include some level of active and passive dissuasion activities. Passive dissuasion is accomplished through the deployment of avian wires in the shape of a canopy over parts of the tailrace just below each dam. Active dissuasion includes staff from the U.S. Department of Agriculture's Animal and Plant Health Inspection Service who patrol the dams and fire long-range pyrotechnics at avian predators in areas where they congregate. Five of the eight mainstem FCRPS project dams also employ limited lethal removal of specific problem birds as needed to reinforce their active dissuasion methods. Project-by-project monitoring and deterrence plans are contained in the Corps' annual Fish Passage Plan for the FCRPS (http://www.nwd-wc.usace.army.mil/tmt/documents/fpp/index.html).

B. Piscine Predator Control

Some predatory fish species, such as the northern pikeminnow, are native to the Pacific Northwest. The Oregon Department of Fish and Wildlife estimated that in the early 1990s, this species consumed an estimated 1.4 million juvenile salmonids in the John Day Reservoir alone. In addition, large populations of non-native predatory fish species such as smallmouth bass, northern walleye, and channel catfish were planted in streams and lakes in the Pacific Northwest during the last two centuries to enhance recreational fishing opportunities. A U.S. Geological Survey biological study found that smallmouth bass consumed about 2 percent of the juvenile spring Chinook and 7 percent of the juvenile fall Chinook passing the Dalles Dam in 2002, and the Washington Department of Fish and Wildlife (WDFW) has reported observations of large populations of channel catfish below the dams in the Snake River and in the Yakima River.

Population control efforts executed by the states of Oregon and Washington with respect to these predators to date have focused on enhancement programs to increase recreational value of non-native predatory fish and increase license sales. In addition, WDFW removed size and daily limits for bass and walleye and daily limits for channel catfish in the mainstem Columbia above McNary Dam beginning in 2013–2014.

To address predatory fish control associated with projects consulted on by NMFS under the ESA, Douglas County Public Utility District (PUD) and Chelan County PUD have included an annual pikeminnow removal program in their Habitat Conservation Plans for the Wells, Rocky Reach, and Rock Island Hydroelectric Projects. Hook-and-line techniques are employed for all three programs during the juvenile out-migration season (April through July) and target fish in project reservoirs larger than 9 inches. Annual catch varies, but averages 10,000 to 15,000 pikeminnow from the Wells; 25,000 to 35,000 from the Rocky Reach; and 25,000 to 35,000 from the Rock Island Reservoir.

C. Pinniped Predator Control

Since the passage of the MMPA amendments in 1994, NMFS has been devoting significant resources and partnering with affected parties to better understand the problem of pinniped predation on at-risk stocks on the West Coast, and to develop

appropriate responses to relieve impacts to coastal communities. A key component of NMFS' program is our fiscal support of and collaboration on the research and monitoring of West Coast pinniped populations and their impacts on specific threatened and endangered salmon stocks in the Columbia-Snake River Basin, and Puget Sound. A number of port authorities in California, Oregon, and Washington have requested NMFS' assistance in addressing their local pinniped predation issues. These ports include the communities of: Monterrey in California; Gold Beach, Newport, and Astoria in Oregon; and Ilwaco and Westport in Washington. NMFS staff work closely with such communities to inform them of the statutory authority to deter marine mammals under section 101(a)(4) of the MMPA to ensure public safety, protect their gear, catch, and private property. These techniques include removing and discouraging haul-out locations on docks and jetties, implementing hazing programs to discourage pinnipeds from predating on fish and interacting with fisheries, and reducing attractants such as through disposal programs for fish carcasses. NMFS assistance includes convening workshops to understand the challenges facing local anglers and communities, and to educate local jurisdictions of the likely impacts if they do not exercise the authorities available to them in addressing this problem.

NMFS is very concerned about the impact robust populations of pinnipeds in the Columbia River and elsewhere in the Pacific Northwest are having on ESA-listed salmon and steelhead stocks. For example, from 2002–2015, California sea lions consumed an estimated total of 45,294 salmonids within ¼ mile of Bonneville Dam. To give perspective on this, total salmonid passage at Bonneville Dam from 2002–2015 was estimated at 2,539,926 fish from January 1 through May 31: the period during which pinnipeds are normally present in the vicinity of Bonneville Dam.

With passage of the MMPA amendments of 1994, Congress recognized the limits of non-lethal deterrence of pinnipeds as a means to protect at-risk, threatened, and endangered salmonids along the West Coast. These amendments included MMPA Section 120, which allows states to apply for authority to lethally remove certain, individually identifiable pinnipeds to protect salmonids.

In accordance with the procedures in Section 120 of the MMPA, the National Environmental Policy Act (NEPA), and the ESA, NMFS authorized in 2008 and 2012 the states of Oregon, Washington, and Idaho to remove or kill individual California sea lions that they determined to be having a significant negative impact on five populations of ESA-listed salmon and steelhead in the Columbia River. Combined, the three states' authorizations allow up to 92 animals to be removed per year. Since receiving removal authority in 2008, the states have permanently removed (to captivity or euthanized) 102 California sea lions.

Preliminary data suggest that our MMPA Section 120 program has been successful overall in reducing the predation rate on salmonids in the immediate vicinity of Bonneville Dam. For example, the Oregon Department of Fish and Wildlife estimates that the Section 120 program has prevented the loss of 15,000–20,000 salmonids at Bonneville Dam since its inception. However, despite the benefits of the program, the number of California sea lions (and predation rates on salmonids) have steadily increased in the past 3 years. Research conducted by NOAA Fisheries' Northwest Fisheries Science Center estimating survival of adult spring/summer Chinook salmon from the Columbia River estuary to Bonneville Dam from 2010 through 2015 suggests that the weighted mean annual survival (adjusted for harvest, detection efficiency at Bonneville Dam, and gear-associated mortality) was 90 percent, 87 percent, 88 percent, 73 percent, 59 percent, and 72 percent, respectively. With known and assumed sources of mortality accounted for,[2] this research suggests that the remaining unaccounted for fish are lost to pinniped predation.

Pinniped predation has also expanded to the Willamette River, where a minimum of 27 and 32 individual California sea lions in 2014 and 2015, respectively, consumed an estimated 5,141 salmonids below Willamette Falls. It is estimated that this represents approximately 10 to 13 percent and 8 to 10 percent of the potential escapement above Willamette Falls of ESA-listed winter-run steelhead and spring-run Chinook in 2014 and 2015, respectively.

Effective implementation of Section 120 of the MMPA has been challenging at times, and it could benefit from minor targeted improvements. NMFS has previously provided testimony to this committee articulating our perspective on suggested improvements. This discussion is most recently detailed in testimony provided by Mr. Barry Thom, Deputy Regional Administrator of the West Coast Region of NMFS on July 15, 2015.

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[2] Natural mortality is generally estimated to be between 2 and 4 percent.

A study published in 2014 by NMFS' Southwest Fisheries Science Center (SWFSC) found that annual overall survival of out-migrating late-fall-run Chinook salmon smolts in the Sacramento River was between 3–16 percent, which is low when compared to survival of salmon in other West Coast rivers including the Snake (27.5 percent survival) and Yakima (28 percent survival), two rivers that have much longer migration corridors. These low survival percentages likely result from a combination of threats, including low flows, degraded habitat and high densities of both non-native (i.e., striped bass, smallmouth bass, and largemouth bass) and native (e.g., pikeminnow) predatory fish species.

Management actions for improving juvenile salmon survival through the Sacramento River and Delta are described in detail in our Central Valley Chinook Salmon and Steelhead Recovery Plan (Recovery Plan). Specific restoration actions in the Recovery Plan are implemented through agency and stakeholder partnerships and through individual competitive grant opportunities. In addition, our 2009 Biological Opinion for the Long-term Operations of the Central Valley Project and State Water Project (OCAP BiOp) specifies that certain actions are the responsibility of the Action Agencies to execute. In the case of the OCAP BiOp, Action Agencies refer to the U.S. Bureau of Reclamation (Reclamation) in coordination with the California Department of Water Resources (DWR). A few of the key strategies are outlined below.

A. Restoring Juvenile Salmonid Rearing Habitat

The vast majority of historic floodplain and wetland habitat in the Central Valley no longer exists or is no longer accessible for juvenile salmonids. Restoring that habitat and access to it is expected to decrease the risk of predation of juvenile salmonids by other fish species because: (1) they will have access to more food, allowing them to grow faster and thereby improve their ability to avoid predation; and (2) the restored wetlands and floodplains will increase habitat complexity and predator refuge areas. Restoring juvenile rearing habitat is a key action in Recovery Plan. In addition, our OCAP BiOP specifies that the Action Agencies will restore 17,000–20,000 acres of floodplain rearing habitat for juvenile winter-run and spring-run Chinook and for Central Valley steelhead in the lower Sacramento River Basin.

B. Management of CVP/SWP Operations Conditions During Winter and Early Spring

NMFS and its Federal and state agency partners (Reclamation, DWR, U.S. Fish and Wildlife Service and California Department of Fish and Wildlife) are working with Delta water users including the Northern California Water Association to pursue four related activities to understand, manage, and reduce the exposure of juvenile winter-run Chinook salmon to negative flows and increased predation in the central and south Delta:

1. Continued partnership and support of the Collaborative Adaptive Management Team (CAMT) and the Salmon Scoping Team;
2. Installation of barriers at Georgiana Slough and other key junctions;
3. Improved enhanced particle tracking modeling; and
4. Real-time salmon monitoring and water export management in the Delta.

Implementing these activities is expected to improve juvenile winter-run Chinook salmon survival by expanding our knowledge of and ability to manage Delta conditions and impacts to ESA species; minimizing the distribution of juveniles from the Sacramento River into the interior Delta; and minimizing juvenile salmonid exposure to reverse flows and predation if they do enter the interior Delta. Of these items, installation of barriers at Georgiana Slough is a requirement of the Action Agencies in our 2009 OCAP BiOp.

C. Modifying Predation "Hot Spots"

The presence of man-made structures in the Sacramento River and Delta likely contributes to increased predation levels of salmonids by other fish species in specific areas where predators congregate in large numbers—termed "hot spots." Red Bluff Diversion Dam in the Sacramento River was one such hot spot until the dam gates were permanently removed by the Action Agencies in 2012 per our 2009 OCAP BiOp. Removing the dam gates greatly improved the flow conditions at the structure in the favor of juvenile salmonids, making them less vulnerable to predation at that site. Consequently, predator densities at the dam decreased after the gates were removed.

D. Isolating Striped Bass within Clifton Court Forebay

Survival of juvenile salmonids through Clifton Court Forebay, on the State Water Project in Contra Costa County, California, is extremely low due to an abundance of striped bass. To fulfill an action required by the 2009 OCAP BiOp to improve juvenile salmonid survival, DWR will this year be initiating a capture and relocation program for striped bass in Clifton Court Forebay. The striped bass will be released in an isolated section of the forebay, eliminating their access to juvenile salmonids in the forebay's open waters. This effort is intended to improve salmonid survival while also enhancing striped bass fishing opportunities in the isolated area.

CONCLUSION

Pacific salmon are of profound importance to healthy ecosystems, cultures, and economies, making their recovery a priority for the Region and the agency as a whole. NMFS has made great progress in recent years toward completion of high-quality salmon and steelhead recovery plans that provide a roadmap to conservation of these listed icons of the Pacific West Coast.

Recovering Pacific salmon and steelhead populations will take decades to achieve, but should ultimately provide long-term economic stability, allow the United States to honor its commitment to tribal reserved fishing rights, and afford maximum regulatory flexibility. NMFS remains committed to investing in Pacific salmon and steelhead recovery in a way that addresses all threats to the species, including predation, in order to ensure our progress toward recovery remains on track.

Thank you again for the opportunity to provide testimony today on this important topic. I appreciate the subcommittee's time and attention to these important issues and I look forward to working with you further. I would be happy to answer any questions you may have.

QUESTIONS SUBMITTED FOR THE RECORD BY REP. JIM COSTA TO MR. WILL STELLE

Question 1. NMFS has in the past requested that the California Fish and Game Commission abolish its striped bass fishing regulations in order to reduce striped bass predation on native fish, including Chinook salmon (both by appearing in front of the Commission and sending written requests). Do you continue believe that this would be advisable? Are you prepared to renew your request or support such a request made by others?

Answer. As reflected in the Final Central Valley Chinook Salmon and Steelhead Recovery Plan (2014), NMFS believes that an effective strategy for improving juvenile salmonid survival includes restoring rearing habitat at a large scale, providing protective flows during juvenile out-migration, minimizing the exposure of juvenile salmonids to areas of high predation (e.g., non-physical barriers to deter juvenile salmonids produced in the Sacramento River from being pulled south into the central and south Delta), modifying predation "hot spots" so conditions at those sites are more in the favor of juvenile salmonids, and conducting research to expand our knowledge of and ability to manage predation impacts on juvenile salmonids. With respect to research, the recovery plan calls for studies to quantify predation and evaluate whether predator control actions (e.g., fishery management or directed removal programs) can be effective at minimizing predation on juvenile salmonids.

Our efforts in 2010 to modify striped bass fishing regulations were developed with our partners at the California Department of Fish and Wildlife (CDFW), as striped bass is a state fishery managed by the California Fish and Game Commission. We continue to work with our partners at CDFW to identify actions to enhance salmonid recovery, including (as stated above) efforts to reduce predation by non-native predatory fish species. We stand ready to support the state of California with any future considerations to address non-native predation, potentially including modifications to state fishing regulations. Any future efforts considered would be based on our best available scientific information and likely include an adaptive management component in order to address scientific uncertainties.

Question 2. The threats assessments for spring-run Chinook salmon, winter-run Chinook salmon, and steelhead that accompany your 2014 California Central Valley Salmon and Steelhead Recovery Plan rank predation in the highest stressor category for each species. What specific steps has NMFS taken to reduce predation effects in the species?

Answer. To address the important threat of predation on juvenile salmonids in the Central Valley, we are: (1) executing the statutory and regulatory authorities grant-

ed to us under the Endangered Species Act (ESA) to require and influence direct action to reduce predation; (2) collaborating with numerous agency and non-agency partners to identify and implement predation minimization projects; and (3) conducting research through our Southwest Fisheries Science Center (SWFSC) to further understand juvenile salmonid movement and survival to better inform recommendations to reduce predation.

Under section 7 of the ESA, our 2009 Biological Opinion for the Long-term Operations of the Central Valley Project and State Water Project (OCAP BiOp) required that the U.S. Bureau of Reclamation (Reclamation) in coordination with the California Department of Water Resources (DWR) take actions that would improve the survival and growth of juvenile salmonids. Multiple actions required under the OCAP BiOp are expected to minimize the effect of predation on juvenile salmonids.

Additionally, NMFS prioritized and completed a programmatic section 7 consultation in order to help expedite Sacramento River salmonid rearing habitat restoration projects being implemented through the Central Valley Project Improvement Act Fish Program. These projects (some of which have been completed and others that are in the planning stages) are intended to increase the amount and diversity of salmonid rearing habitat in the Central Valley, which is expected to result in faster juvenile salmonid growth rates and reduced vulnerability to predation.

In addition, NMFS is currently partnering with the Golden Gate Salmon Association and CDFW to work with the city of Redding to reduce light impacts at the Sundial Bridge over the Sacramento River in order to minimize predation on juvenile salmonids. NMFS also regularly provides engineering support to help design or modify structures in a way that minimizes predation opportunities for striped bass and other predators.

Question 3. Do you believe that spring-run and winter-run Chinook salmon can be recovered without addressing predation by non-native black bass and striped bass? If not, what steps is NMFS prepared to take to address the issue?

Answer. Although predation is one of several key threats that will need to be addressed before spring-run and winter-run Chinook salmon can be recovered, as stated in our testimony, no single factor holds the key to recovering Pacific salmon and steelhead stocks. Each factor, each threat, must be addressed and reduced.

Addressing sources of predation is a key component of our strategy to recovering threatened and endangered Pacific salmon and steelhead, but it is not the only effort we are taking to restore these populations. NMFS has made great progress in recent years toward completion of high-quality salmon and steelhead recovery plans that provide a roadmap to conservation of these listed icons of the West Coast. Our Final Central Valley Chinook Salmon and Steelhead Recovery Plan contains a suite of actions aimed at reducing juvenile mortality and lays out specific objectives for recovering the species. In addition, NMFS recently announced our Species in the Spotlight program, which highlights winter-run Chinook as one of eight most at-risk endangered species nationwide. As part of the Species in the Spotlight effort, NMFS has released a Sacramento River winter-run Chinook Priority Action Plan, which contains a suite of actions NMFS and our partners can take in the next 5 years to promote species recovery, including improved temperature management of Shasta Reservoir, restoration of key spawning and rearing habitat, reintroduction to historic habitat and actions to improve through Delta survival of juveniles.

With respect specifically to non-native predation impacts, NMFS is taking multiple steps in order to execute a predation minimization strategy that includes restoring rearing habitat at a large scale, providing protective flows during juvenile out-migration, minimizing the exposure of juvenile salmonids to areas of high predation (e.g., non-physical barriers to deter juvenile salmonids produced in the Sacramento River from being pulled south into the central and south Delta), modifying predation "hot spots" so conditions at those sites are more in the favor of juvenile salmonids, and conducting research to expand our knowledge of and ability to manage predation impacts on juvenile salmonids.

Question 4. Results of juvenile salmon survival studies in the south Delta and lower San Joaquin River have shown consistent high levels of mortality (>95 percent) for juveniles migrating through the Delta over the past decade. There is speculation that predation by largemouth bass, striped bass, and catfish is a significant factor contributing to the high mortality rates.

4a) What is NMFS doing to better characterize the importance of predation mortality in the Delta on juvenile salmonid survival?

Answer. NMFS has been working for several years with DWR and CDFW to study dynamics of predation on Sacramento-San Joaquin Delta salmonids and to evaluate

predation by non-native fish and birds on juvenile steelhead in rivers and lagoons on California's central coast. This work has included striped bass studies and potential removal methods for use in the Pajaro River and the Carmel River lagoon. Our recent focus on predation in the Delta and elsewhere in the Central Valley was triggered by observations of unexpectedly high and localized areas of mortality, coming from tagging studies conducted annually since 2008. In 2016, with funding from CDFW, NMFS SWFSC scientists will investigate the distribution, abundance and habitat associations of significant predators of juvenile salmon and identify areas of high predation mortality. Results of this study will give insight into potential management actions that could reduce predator impacts on juvenile salmon.

4b) What is NMFS doing to determine where predation mortality is greatest?

Answer. In collaboration with the University of California-Davis, the U.S. Fish and Wildlife Service (USFWS), and CDFW, NMFS has been tagging juvenile salmon with acoustic transmitters and monitoring their movement and survival from rivers through the Delta and into the ocean since January 2007. This monitoring has identified a variety of areas where predation is especially high, and the data are being used to develop a model of migration and survival that will allow us to examine how water project operations (including physical and non-physical barriers) influence survival rates by altering salmonid migration paths and fish residence times in the Delta.

4c) How do environmental conditions such as San Joaquin River flow and SWP/CVP exports affect the vulnerability of juvenile salmonids to predation?

Answer. While it is clear that high flows are associated with high survival of salmonids, and low flows are associated with low survival, incremental flow adjustments may not have corresponding incremental effects on salmonid survival because flow is probably not directly influencing predation on salmonids in a linear, straightforward way. Depending on the time scale of interest, flow can affect the behavior, activity, and distribution of predators, salmon, and alternative prey throughout their habitats.

Predation is an important proximate cause of low salmon survival, but the predator-prey interactions happen in an environment that is strongly influenced by current and historical management actions, such as channelization, bank armoring, highly altered hydrographic conditions, numerous introduced species, including piscivorous fish, various other fish prey species, and vegetation, etc. Thus, the context matters.

Below are some key citations to support the general scientific understanding about the relationship between flow and predation. More detail and citations can be provided, if desired.

FLOW AND PREDATION CITATIONS

- High salmonid survival is associated with high flows, as shown in coded-wire-tag and acoustic tag survival studies.
  - —Newman, K.B. and Brandes, P.L. (2010). Hierarchical modeling of juvenile Chinook salmon survival as a function of Sacramento-San Joaquin Delta water exports. North American Journal of Fisheries Management, 30(1), 157–169.
  - —Newman, K.B. (2003). Modelling paired release-recovery data in the presence of survival and capture heterogeneity with application to marked juvenile salmon. Statistical Modelling, 3(3), 157–177.
  - —Michel, C.J., Ammann, A.J., Lindley, S.T., et al. (2015). Chinook salmon out-migration survival in wet and dry years in California's Sacramento River. Canadian Journal of Fisheries and Aquatic Sciences, 72(11), 1749–1759.
- Salmon returns are often higher after periods of high flows during juvenile migrations. (This is clearly observed in escapement data, but it has also been shown statistically.)
  - —Speed, T. (1993). Modelling and managing a salmon population. Pages 267–292 in V. Turkman and K.F. Barnett, editors. Statistics for the environment. J. Wiley and Sons, New York.

- High (natural) flows often are associated with high turbidity, which reduces the vulnerability of prey to visual predators.
  - —Gregory, R.S. and Levings, C.D. (1998). Turbidity reduces predation on migrating juvenile Pacific salmon. Transactions of the American Fisheries Society, 127(2), 275–285.
- Juvenile salmon migrate faster when flows are high, which may reduce their exposure time to predators.
  - —Smith, S.G., Muir, W.D., Hockersmith, E.E., et al. (2003). Influence of river conditions on survival and travel time of Snake River subyearling fall Chinook salmon. North American Journal of Fisheries Management, 23(3), 939–961.
  - —Connor, W.P., Burge, H.L., Yearsley, J.R., et al. (2003). Influence of flow and temperature on survival of wild subyearling fall Chinook salmon in the Snake River. North American Journal of Fisheries Management, 23(2), 362–375.
  - —Connor, W.P., Steinhorst, R.K. and Burge, H.L. (2003). Migrational behavior and seaward movement of wild subyearling fall Chinook salmon in the Snake River. North American Journal of Fisheries Management, 23(2), 414–430.
  - —Michel, C.J., Ammann, A.J., Chapman, E.D., et al. (2013). The effects of environmental factors on the migratory movement patterns of Sacramento River yearling late-fall run Chinook salmon (*Oncorhynchus tshawytscha*). Environmental Biology of Fishes, 96(2–3), 257–271.
  - —Anderson, J.J., Gurarie, E., and Zabel, R.W. (2005). Mean free-path length theory of predator-prey interactions: application to juvenile salmon migration. Ecological Modelling, 186(2), 196–211.
- High flows (if high enough) inundate floodplains where salmonid growth and survival conditions are better.
  - —Sommer, T.R., Nobriga, M.L., Harrell, W.C., et al. (2001). Floodplain rearing of juvenile Chinook salmon: evidence of enhanced growth and survival. Canadian Journal of Fisheries and Aquatic Sciences, 58(2), 325–333.

4d) Can the San Joaquin River fall-run Chinook salmon population remain self-sustaining in light of the high levels of juvenile mortality?

Answer. San Joaquin River fall Chinook (SJRFC) is not listed under the ESA, but is managed by NMFS, in conjunction with the Pacific Fishery Management Council (PFMC) and state of California, under the authority of the Magnuson-Stevens Fishery Conservation and Management Act (MSA). The PFMC's Pacific Coast Salmon Fishery Management Plan (FMP) and associated documents provide more information on the status of the stock and how ocean fisheries that affect that stock are managed. SJRFC is one of three stocks in the Central Valley fall Chinook complex. Because there is less information for SJRFC, Sacramento River fall Chinook is used as the indicator stock for the larger stock complex. Additional information related to how the stocks are managed is provided in Question 4e (below).

4e) Although fall-run Chinook salmon have not been listed for protection under the Federal Endangered Species Act, what is the responsibility and authority of NMFS to address management issues such as predator control under the provisions of Essential Fish Habitat or other authority given the commercial importance of fall-run Chinook salmon?

Answer. As discussed in question 4d (above), NMFS manages SRFC via its authority under the MSA. NMFS monitors the status of the stock and manages ocean fisheries that affect the stock to insure that it is neither overfished or subject to overfishing. Although predation on the stock is not assessed by NMFS directly, it is one of the many sources of mortality that is accounted for implicitly as NMFS monitors spawning escapement and compares it to the conservation objective for the stock's management (contained in the Pacific Coast Salmon FMP). The record of escapements for SRFC and SJRFC are available in the PFMC's stock assessment documents (Tables B1 and B2 in http://www.pcouncil.org/wp-content/uploads/2016/02/Review_of_2015_Salmon_Fisheries_FullDocument.pdf).

The MSA and the Pacific Coast Salmon FMP provide additional protection for SRFC by considering the effects of actions to Essential Fish Habitat (EFH). The MSA established a requirement for Federal agencies to consult with the NMFS on actions that may adversely affect EFH, and for NMFS to provide EFH Conservation Recommendations to Federal agencies to avoid, minimize, mitigate, or otherwise off-

set adverse effects to EFH. [Under the regulations implementing the EFH provisions of the MSA, EFH is defined as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity," and necessary is defined as the "habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem." An adverse effect is defined as "any impact that reduces the quality and/or quantity of EFH."]

Although compliance with NMFS' EFH Conservation Recommendations is not mandatory, the Federal action agency must provide a written response within 30 days that either describes the measures the agency proposes to avoid, minimize, or offset the impact of the activity, or explains the reasons for not following the recommendations. In addition, Regional Fishery Management Councils and NMFS are required to review the EFH provisions of FMPs and revise or amend them as warranted based on the best available information at least every 5 years. The most recent EFH revisions for the Pacific Coast Salmon FMP were made in 2014.

4f) What management actions is NMFS planning to implement to help reduce predation mortality at specific predation hot spots and on a broader regional scale?

Answer. As stated in Question 3 (above), NMFS is using its authorities and partnerships to pursue a predation minimization strategy that includes restoring rearing habitat at a large scale, providing protective flows during juvenile out-migration, minimizing the exposure of juvenile salmonids to areas of high predation (e.g., non-physical barriers to deter juvenile salmonids produced in the Sacramento River from being pulled south into the central and south Delta), modifying predation "hot spots" so conditions at those sites are more in the favor of juvenile salmonids, and conducting research to expand our knowledge of and ability to manage predation impacts on juvenile salmonids.

NMFS' role under section 7 of the ESA is to work with Federal action agencies on projects to operationalize predator control efforts. NMFS provides the action agencies with technical assistance and expertise on the design of such programs. Under the 2009 OCAP BiOp, the action agencies (Reclamation, in partnership with DWR) removed the gates at Red Bluff Diversion Dam in 2012 to reduce predator congregation in the area. Removing the dam gates greatly improved the flow conditions at the structure in the favor of juvenile salmonids, making them less vulnerable to predation at that site. Consequently, predator densities at the dam decreased after the gates were removed.

This year, DWR will be initiating a capture and relocation program for striped bass in Clifton Court Forebay to fulfill another action required by the NMFS 2009 OCAP BiOp to improve juvenile salmonid survival. As you know, survival of juvenile salmonids through Clifton Court Forebay, on the State Water Project in Contra Costa County, California, is extremely low due to an abundance of striped bass. As part of DWR's effort this year, the striped bass will be released in an isolated section of the forebay, eliminating their access to juvenile salmonids in the forebay's open waters. This effort is intended to improve salmonid survival while also enhancing striped bass fishing opportunities in the isolated area.

Question 5. Several years ago the California Department of Fish and Wildlife recommended that the California Fish and Game Commission adopt changes to striped bass recreational harvest limits in the Delta and rivers that would promote greater harvest of adult striped bass thereby reducing the abundance of one of the major predatory fish impacting juvenile salmon and steelhead survival. NMFS supported the proposed management changes.

5a) What other management actions is NMFS considering to reduce predation mortality?

Answer. As stated in Question 1 (above), NMFS' efforts in 2010 to modify striped bass fishing regulations were developed with our partners at the CDFW, as striped bass is a state fishery managed by the California Fish and Game Commission. We continue to work with our partners at CDFW to identify actions to enhance salmonid recovery including efforts to reduce predation by non-native predatory fish species. We stand ready to support the state of California with any future considerations to address non-native predation, potentially including modifications to state fishing regulations. Any future efforts considered would be based on our best available scientific information and likely include an adaptive management component in order to address scientific uncertainties.

NMFS is otherwise using its authorities and partnerships to pursue a predation minimization strategy that includes restoring rearing habitat at a large scale, providing protective flows during juvenile out-migration, minimizing the exposure of juvenile salmonids to areas of high predation (e.g., non-physical barriers to deter

juvenile salmonids produced in the Sacramento River from being pulled south into the central and south Delta), modifying predation "hot spots" so conditions at those sites are more in the favor of juvenile salmonids, and conducting research to expand our knowledge of and ability to manage predation impacts on juvenile salmonids.

5b) In the Pacific Northwest, bounties have been placed on predatory fish such as pikeminnow. Has that program on the Columbia River proven to be successful in reducing predation mortality?

Answer. The northern pikeminnow bounty program, funded by Bonneville Power Administration, has a goal of maintaining an exploitation rate of 10 to 20 percent on fish 9 inches or longer.[1] A recent evaluation[2] indicates that, as a result of this program, pikeminnow predation on juvenile salmon has declined by about 40 percent, saving 3 to 5 million juvenile salmon annually that would otherwise have been eaten by this native predator.

5c) Is NMFS considering a similar action for the Sacramento and San Joaquin Rivers and Delta?

Answer. NMFS is not currently considering recommending bounties on predatory fish in the Sacramento and San Joaquin Rivers and Delta. We stand ready to support the state of California, CDFW and the California Fish and Game Commission with any future considerations to address predation, potentially including modifications to state fishing regulations.

5d) Is NMFS considering recommending implementation of management actions such as a mark-select fishery similar to that in Washington and elsewhere as a method to improve survival of wild Central Valley Chinook salmon?

Answer. NMFS is in the process of evaluating the risks and benefits of a mark-selective salmon fishery off the CA coast. A report will be prepared once results from this study are available.

5e) What other alternative management actions is NMFS investigating or proposing to implement that would contribute to reducing juvenile mortality and contributing to meeting recovery plan objectives?

Answer. As stated in Question 3 (above), NMFS has made great progress in recent years toward completion of high-quality salmon and steelhead recovery plans that provide a roadmap to conservation of these listed icons of the Pacific West Coast. Our Final Central Valley Chinook Salmon and Steelhead Recovery Plan contains a suite of actions aimed at reducing juvenile mortality and lays out specific objectives for recovering the species. In addition, NMFS recently announced our Species in the Spotlight program, which highlights winter-run Chinook as one of eight most at-risk endangered species nationwide. As part of the Species in the Spotlight effort, NMFS has released a Sacramento River winter-run Chinook Priority Action Plan, which contains a suite of actions NMFS and our partners can take in the next 5 years to promote species recovery, including improved temperature management of Shasta Reservoir, restoration of key spawning and rearing habitat, reintroduction to historic habitat and actions to improve through Delta survival of juveniles.

Question 6. Results of monitoring juvenile winter-run Chinook salmon production and survival in the Sacramento River upstream of Red Bluff have shown evidence of high egg-fry mortality (approximately 95 percent mortality) in 2014 and 2015.

6a) What changes in management actions does NMFS anticipate will be implemented in 2016 to improve juvenile winter-run Chinook salmon abundance?

Answer. Sacramento River winter-run Chinook continue to be greatly affected by California's extended drought, as evidenced by high egg-fry mortality in 2014 and 2015. Winter-run Chinook is one of eight species that NOAA is highlighting in our "Species in the Spotlight" Initiative, focusing our attention and resources to managing this species carefully and hopefully reverse its trajectory toward extinction. This species is important not only because it is the last population of winter run in the Sacramento River, but also because its population affects a host of activities in the Bay Delta, including ocean, commercial and recreational fishing; Delta operations and pumping regimes; and probably most significantly in the last 2 years, the timing and extent of rice growing in the Sacramento Valley.

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[1] Northern pikeminnow are a relatively long-lived species, often taking 4 to 6 years to reach a length of 9 inches. Smaller fish (<9 inches) feed primarily on aquatic insects while larger fish (>9 inches) feed primarily on fish, including juvenile salmon, and crayfish.

[2] BPA, COE, and USBR. 2014. 2014 Annual Progress Report, Section 2, pg 71.

Winter run are highly vulnerable to water temperatures in their current spawning range below Shasta Reservoir. We will need to be very conservative with Shasta Reservoir operations from now through early fall 2016 in order to augment and stretch out the cold water pool, given that two out of three winter-run cohorts are likely to have suffered year class failures. The California State Water Resources Control Board had a hearing on issue of the 2016 Shasta Temperature Management Plan on March 18. In addition, on March 25, Reclamation submitted to NMFS their temperature management plan for ESA concurrence prior to issuing their initial Water Year 2016 allocations. Looking to the long term, it is critical that we continue to pursue efforts to reintroduce these salmon to their historic spawning range in the upper Sacramento River watershed, and also Battle Creek, if we hope to achieve recovery.

6b) Will juvenile winter-run salmon production in the Livingston-Stone hatchery be increased in 2016?

Answer. Juvenile winter-run Chinook salmon production in Livingston Stone National Fish Hatchery was tripled in 2014 and doubled in 2015 in anticipation of a smaller quantity and quality of water in Shasta Reservoir that would not provide sufficient habitat for wild winter-run salmon throughout their incubation period (through October). It is too early at this point in the water year to determine how the hydrology and Shasta Reservoir (storage and cold water pool) will shape up to evaluate whether there is a need to increase winter-run Chinook production at Livingston Stone National Fish Hatchery in 2016.

6c) Will the recreational salmon and trout fisheries be closed or modified to protect winter-run adults prior to spawning in the upper Sacramento River?

Answer. Yes. The California Fish and Game Commission adopted CDFW's proposed closure to all fishing, effective April 1 through July 31, 2016, from 650 feet below Keswick Dam to the Highway 44 Bridge.

6d) Does NMFS anticipate that the low juvenile production in 2014 and 2015 will result in greater constraints on water project operations or ocean commercial fisheries? What management changes are expected?

Answer. All of the surviving juvenile Sacramento River winter-run Chinook salmon from broodyear 2014 are currently in the Pacific Ocean. March is typically the month when the majority of juvenile winter-run Chinook stop rearing in the Delta and out-migrate into the Pacific Ocean. NMFS' 2009 OCAP BiOp already includes requirements to protect juvenile winter-run Chinook in the Delta for the remainder of broodyear 2015's freshwater residence time. Therefore, NMFS does not anticipate that the low juvenile production in 2014 and 2015 will result in greater constraints on water project operations.

Ocean salmon fisheries are managed in direct response to the status of ESA-listed salmonids. If the status of listed salmonids diminishes, it is reasonable to expect that ocean salmon fisheries would be further constrained and that those constraints would last longer into the future than would have otherwise occurred. Ocean salmon fishery management measures are discussed at the March and April meetings of the Pacific Fishery Management Council each year.

Question 7. In 2012, the Golden Gate Salmon Association produced a California salmon rebuilding plan. Your agency and the other fish agencies provided technical assistance in developing that plan. The plan included 39 hot spot predation locations where physical changes would reduce predation. It is my understanding that none of these projects have been implemented. What are the reasons these projects have not been implemented? Does NMFS support these projects and feel that they would reduce predation effects and improve species recovery efforts?

Answer. NMFS is supportive of projects that address physical conditions at specific locations in order to reduce predation on juvenile salmonids. This approach to reducing predation is consistent with our Final Recovery Plan for Central Valley Chinook salmon and steelhead, and it is standard practice for NMFS engineers to help modify or design in-water structures to minimize predation opportunities.

NMFS has been providing technical assistance to Golden Gate Salmon Association (GGSA) on their current salmon projects since 2012. GGSA's salmon rebuilding plan identifies 39 total projects that address a variety of stressors, and a small subset of these projects focus on addressing predation hot spots. Within that subset, efforts to address predation at two of the hot spots (Sundial Bridge and Clifton Court Forebay) have been or are currently being implemented. In addition, NMFS is currently providing technical assistance for a project to address a third hot spot (Freeport pipeline).

Question 8. Clifton Court Forebay, at the site of the State Water Project pumping plant, is a known source of serious predation. A recent study indicated that 81 percent of the juvenile salmon pulled into Clifton Court perish from predation. In 2009, NMFS released a number of biological opinions that required changes to protect the ESA listed winter- and spring-run salmon. One of these was RPA IV.4.2(2) requiring a reduction of the predation at Clifton Court Forebay to 40 percent of what it was. That RPA required full compliance by March 31, 2014. It is our understanding that NMFS has approved continued delays for this action. Please explain why these delays were approved and what has been the impact of those delays on the near total loss of the listed winter-run salmon.

Answer. To achieve RPA IV.4.2(2) in the NMFS 2009 OCAP BiOp, DWR initially proposed creation of a fishing pier to provide additional fishing opportunity and increase fishing pressure on predators of juvenile salmonids in Clifton Court Forebay. Further analyses of this proposal indicated that it would likely not meet the predation reduction requirements included in this RPA action. As a result of this analysis, NMFS continued to provide technical assistance to DWR identify new actions that could achieve the 40 percent predation reduction target at Clifton Court Forebay included in RPA IV.4.2(2).

This year, DWR will be initiating a capture and relocation program for predators in Clifton Court Forebay to fulfill RPA Action IV.4.2(2). As part of this effort, the striped bass will be released in an isolated section netted off from the rest of the forebay, eliminating their access to juvenile salmonids in the rest of the forebay. This effort is intended to improve salmonid survival while also enhancing striped bass fishing opportunities in the isolated area.

Question 9. In 2009, NMFS issued a biological opinion and RPA IV.4.3 that required a 50 percent reduction in the predation that takes place at the Department of Water Resources discharge points where juvenile salmon from the pump salvage system are discharged into a pipe. Predation at those locations is known to be high. The RPA also required an evaluation of a "net pen" system as a potential better technology for discharging the juveniles. It is my understanding that this evaluation has not taken place and that instead, DWR has installed another $6 million pipe location. Can you please explain why this RPA was not carried out as directed? The RPA also required monitoring of results. Can you please provide a monitoring report on the success or failure of the $6 million installation to achieve the 50 percent reduction?

Answer. In May 2010, DWR released a Final Release Site Predation Study Report to describe predation upon release salmonids following their salvage at the Federal and state facilities of the Central Valley and State Water Projects (respectively). In August 2010, DWR followed with a release of an Evaluation of Mortality and Injury in a Fish Release Pipe report. Following plans outlined in these reports, a complete refurbishment of the Curtis Landing release site was completed in 2014, and the site became operational in early 2015. Predation monitoring has been ongoing at the Curtis Landing and Horseshoe Bend sites since the Curtis Landing site returned to operation.

In addition, DWR is currently developing a comprehensive plan to monitor predation at the new and existing discharge sites. Two new fish release sites on Sherman Island are currently under final design and permitting. These sites are scheduled for completion in 2017. Reclamation has taken the lead on analyzing opportunities for transporting and releasing fish by barge to these new release locations. We anticipate receiving a proposal from them for review in the coming year.

Dr. FLEMING. Thank you, Mr. Stelle. Excellent testimony and perfect timing, sir. You are a model for all of us.

Mr. Grossman, you are now recognized for 5 minutes.

STATEMENT OF GARY D. GROSSMAN, PROFESSOR OF ANIMAL ECOLOGY, WARNELL SCHOOL OF FORESTRY AND NATURAL RESOURCES, UNIVERSITY OF GEORGIA, ATHENS, GEORGIA

Dr. GROSSMAN. My name is Gary Grossman. Since 1981, I have been a professor of animal ecology at the University of Georgia. I would like to thank the Chair and Ranking Member for the honor

of this appearance, and reserve the right to revise my written testimony.

My primary research areas include population and community dynamics and habitat selection in fishes, and I have published over 115 scientific papers cited over 5,000 times. For the last 20 years, I have advised fisheries agencies in California, and in 2013 led a public hearing on the effects of fish predation on endangered salmonids that produced a technical report. I have recently completed a general review of the effects of predators on Sacramento and San Joaquin Delta fishes to be published in the *State of the Delta Science*.

I will focus on California's Central Valley endangered salmon, but my comments also apply to other species and habitats.

Unfortunately, the endangered salmon in the Central Valley reside in a highly altered habitat. Thus, it is difficult to establish a hierarchy of factors affecting salmon mortality. Consequently, assigning a value to the potential increases in salmon abundance that would be produced by predator control is problematical, when compared to increases potentially produced by remediation of other negative influences, such as degraded habitat, altered flow regime, and contaminants.

Pacific salmon are born in rivers and streams, migrate to the ocean to mature, and then return to home streams to reproduce and die. To survive, they run a predatory gauntlet ranging from aquatic insects to predatory fishes, mammals, and birds. Most predation on salmon occurs when young fish migrate downstream to their oceanic adult habitat. When considering salmon mortality, one must distinguish between proximate and ultimate causes of death, because management efforts, expensive as they are, only will be successful if they address ultimate causes.

Predation is frequently a proximate cause of mortality, because virtually any factor that weakens or disorients a salmon will increase the probability of predation. For example, copper concentrations commonly found in Delta waters produce abnormal behaviors in coho salmon that render them much more susceptible to predators. In this case, predation may be the proximate cause of mortality, but a contaminant actually is the ultimate cause.

An additional complication potentially negating the effects of predator control measures is compensation by other predators. The removal of one invasive predator could easily result in an increase in abundance of a second invasive predator, with no net increase whatsoever in salmon abundance. The law of unintended consequences is alive and well on Mother Earth.

My review of extant data indicates that six species of fishes and two bird species feed on endangered salmon in Central California, but 24 other predatory species have the potential to consume endangered salmon. Nonetheless, I cannot reach a definitive conclusion regarding the effects of predation mortality on Central Valley endangered salmon, because the database is neither extensive nor thorough. Mathematical models suggest that predators may influence salmon mortality, but these results have not been confirmed empirically.

Finally, with the exception of lamprey control—and lamprey is not a predator of issue here on the West Coast—there really is no

strong evidence that historic predator control efforts have resulted in substantial increases in salmon populations, despite considerable reductions in predator abundance.

California's endangered Central Valley salmon live and migrate through altered habitats that support a multitude of invasive predators. Control of predatory fishes has the advantage of being logistically feasible by elimination of catch and gear restrictions, or even bounties, as we have seen with northern pikeminnow. Predator control also, to be frank, is more politically tractable than some aspects of habitat remediation, such as reducing water exports from the Delta.

From a scientific perspective, there is nothing wrong with trying invasive predator control as an experimental management strategy. After all, nature is full of surprises. Nonetheless, I would not predict it will yield clear positive results, and it does divert funds from other, potentially more productive, management approaches. Based on the evidence at hand, I believe efforts to increase endangered salmon should focus on habitat and flow restoration, contaminant remediation, and alteration of artificial structures that disorient and trap fish.

And thank you for this opportunity.

[The prepared statement of Dr. Grossman follows:]

PREPARED STATEMENT OF PROFESSOR GARY D. GROSSMAN, WARNELL SCHOOL OF FORESTRY AND NATURAL RESOURCES, UNIVERSITY OF GEORGIA, ATHENS, GEORGIA

My name is Gary Grossman and since 1981 I have been a professor of animal ecology at the University of Georgia. I received my BSc degree from the University of California at Berkeley in 1975 and my PhD from the University of California at Davis in 1979. I would like to thank the Chair and Ranking Member of the Subcommittee on Water, Power and Oceans, for the honor of this appearance and reserve the right to revise my written testimony if further information will aid the subcommittee.

My primary fields of research are population and community dynamics and habitat selection in fishes and I have published over 115 scientific papers which have been cited over 5,000 times. In 2014 I won the American Fisheries Society's Sullivan Award for excellence in fisheries conservation and in 2015 I was elected to the first class of Fellows of that Society.

My expertise in the issue of predation on endangered salmon is based on ~20 years of fisheries advisory work in various forms for the state and Federal agencies that manage the Sacramento-San Joaquin Delta. In 2013 I led the public hearing on the effects of fish predation on Steelhead Trout and endangered Chinook Salmon populations in the Delta and senior authored the report produced by the technical panel from the hearing. At present I have completed a general review of the effects of predation on Delta fishes that will be published in the upcoming volume on "State of the Delta Science."

My testimony is based on my experience with endangered Central Valley Chinook Salmon, but the principles I discuss are general and likely apply to many species and habitats. Unfortunately, the endangered salmon in California's Central Valley both live and traverse highly altered habitats, which make it difficult to create a hierarchy of factors limiting their abundance. In addition, many of the factors that are known to negatively affect endangered salmon, such as habitat alterations and water diversions for agriculture, domestic and industrial consumption, and toxicant burdens, are difficult to alter. Consequently, at present it is problematical to assign a value to the potential increases in endangered salmon abundance that will be produced by a reduction in invasive predators versus the potential increases produced by remediation of the many other factors that negatively affect endangered salmon populations (e.g. degraded habitat and flow regimes, contaminants, and artificial structures that disorient salmon and alter migration routes).

For those of you who are not from Pacific states, it should be helpful to briefly review the life history patterns of Pacific salmon. All salmon are born in rivers and streams, and spend between several months and 2 years in freshwater. The young, called smolts, then migrate downstream through estuaries and out into the open

ocean where they quickly grow to adult size. Pacific salmon spend 1–4 years in the ocean before migrating home to their birth streams, reproducing and dying. This complex life history forces Pacific salmon to run a predatory gauntlet beginning with aquatic insects that consume eggs to predatory fishes, birds, mammals, and perhaps a few reptiles and amphibians that consume young salmon and smolts. Indeed, most of the mortality experienced by salmon occurs in the freshwater stage or on the migration to the ocean. Adults also face predation from a few large oceanic fishes such as sharks and mammals like seals and bears. Nonetheless, for hundreds of millions of years Pacific salmon co-existed with native peoples and predators; it is only when humans altered the environment substantially and introduce non-native predators that problems started to occur.

When considering the effects of predators on endangered salmon it also is necessary to examine the impact of proximate and ultimate factors on mortality. Proximate causes are factors that contribute to mortality but are not the main causal factor. They represent factors that even if substantially reduced, may have little effect on mortality. By contrast, an ultimate factor is the primary causal agent influencing a process like mortality. Manipulation of an ultimate factor for predation should produce a significant positive effect on abundance. In general, predation may be either a proximate or ultimate cause of mortality, but for endangered salmon in California's Central Valley it is likely the former rather than the latter. This obtains because, virtually any environmental factor that weakens or disorients a young salmon will increase the probability that it will be eaten by a predator. Unfortunately, endangered salmon in California's Central Valley face a constellation of factors that likely weaken or confuse migrating smolts including: habitat alterations, altered flows and water removals, and contaminants. It is these factors that could easily be the ultimate cause of predation mortality.

To examine just one of these factors, the presence of contaminants in the Sacramento-San Joaquin Delta; researchers have detected the presence of the following harmful agents: estrogen disruptors, psychoactive drugs, ammonia, Triclosan, and metallic compounds such as selenium, mercury, copper, and aluminum. Before endangered salmon smolts can reach the Pacific Ocean, they must traverse the Delta, where these contaminants are present in concentrations capable of causing abnormal behavior in fishes (Sloman and Wilcox 2006, Connon et al. 2011, Brooks et al 2012, Conner et al. 2016). In fact, Sandahl et al (2007) demonstrate that copper concentrations commonly found in Delta waters produce abnormal anti-predatory behaviors in coho salmon. Their video (http://pubs.acs.org/doi/suppl/10.1021/es062287r) shows control salmon ceasing movement and dropping to the bottom of the tank when exposed to a fright stimulus, whereas fish exposed to copper continue moving around the tank in an agitated and highly visible manner. This behavior almost certainly renders young salmon more susceptible to predation and illustrates the principle of proximate and ultimate causes. In this case, predation would be the proximate cause of mortality but contaminants would be the ultimate cause. The greater the number of factors that stress young salmon, the greater the number of potential proximate causes of mortality and the greater the difficulty of undertaking management actions that will unambiguously result in decreased mortality and increased abundance of endangered salmon.

An additional issue that must be addressed when evaluating the impact of predators on endangered salmon is compensation by other predators. Most predators on salmon are generalized feeders that consume a diverse array of prey. Consequently, a management strategy that reduces the abundance of an invasive predator, say striped bass in the Sacramento-San Joaquin Delta, might not result in an increase in endangered salmon abundance, because another predator might increase in abundance and consume an identical amount of salmon. Even worse, eliminating a predator also has the effect of eliminating a potential prey (young of the predator) for other predators and in the worst case scenario might lead to these predators increasing their predation rate on endangered salmon. The law of unintended consequences is alive and well on Mother Earth.

I have surveyed the scientific literature and ongoing studies on predators of fishes in the Delta (Grossman 2016) and recorded eight species that fed upon endangered salmon: striped bass, largemouth bass and smallmouth bass, black crappie, white catfish, channel catfish, Caspian and California Least Terns. Nonetheless, 24 other predatory species have the potential to feed on endangered salmon. Despite the wide range of potential predators it is problematical to reach a conclusion regarding the effects of predation mortality on California's Central Valley endangered salmon because the database is neither extensive nor thorough (most data depict the presence or absence of salmon from a few samples). For example, data are completely lacking for some potentially major predators such as river otters. Predation on endangered Chinook Salmon does occur, but its impact on populations of this species cannot be

ascertained given the data at hand. Several mathematical models (Lindley and Mohr 2003, Loboschefsky et al. 2012, Nobriga et al. 2013) do suggest that predation may have significant impacts on endangered salmon, but these studies, although yielding insights regarding the potential impacts of predators on this species, have not been verified empirically.

Finally, the history of predator control to increase salmon abundance has not been markedly successful. The Northern Pikeminnow Sport-Reward Program began in 1991 in the Columbia River and pays anglers to harvest predatory size fish (Porter 2010). The program removed over 2.2 million fish during 1998–2009 and is believed to have reduced predation on juvenile salmonids, but positive effects on salmonid populations have been difficult to detect (Carey et al. 2012).

California's endangered Central Valley salmon live and migrate through altered habitats that support a multitude of invasive predators capable of consuming endangered salmon. Control of predatory fishes has the advantage of being logistically feasible (managers can just remove restrictions on catch and gear, or even set a bounty on the fish as per pikeminnow control in the Columbia River). Predator control also is likely more politically tractable than some aspects of habitat remediation such as reducing water exports from the Delta. From a scientific perspective, there is nothing wrong with trying invasive predator control as an experimental management strategy. After all, nature is full of surprises. Nonetheless, I would not predict it will yield clear positive results and it does divert funds from other, potentially more productive management approaches. Based on the evidence at hand, I believe efforts to increase endangered salmon should focus on habitat and flow restoration, contaminant remediation and alteration of artificial structures that disorient and trap fish.

Thank you for the opportunity to address the House Subcommittee on Water, Power and Oceans, and I will be glad to answer any questions you may have.

[References for this statement are included in the record and retained in the Committee's official files]

Dr. FLEMING. Very good, Mr. Grossman. You came even a little bit closer to the limit.

[Laughter.]

Dr. GROSSMAN. I would normally take a couple of weeks to cover this subject in class, so I apologize for reading, but it is a lot of material to cover.

Dr. FLEMING. No. Hats off to you to pack all of that in 5 minutes. Thank you.

And finally, we have Mr. Doug Demko. Sir, you are recognized for 5 minutes.

STATEMENT OF DOUG DEMKO, PRESIDENT, FISHBIO, CHICO, CALIFORNIA

Mr. DEMKO. Good morning, and thank you for the opportunity to be here. I am going to review a few of the key points from my written testimony and then, obviously, look forward to questions later on today.

I have been in fisheries since the 1980s. This was around the time when ESA was just resulting in large-scale efforts to conserve or to save salmon. I now have a company that specializes in research, monitoring, and conservation of fish, with a few offices in California and one in Asia. So, I like to think that I have a lot of good, on-the-ground, practical research experience.

Over the years, I have worked with Native tribes, all of the state agencies from the West Coast, many Federal agencies, and now, for the last 5 or 6 years, foreign and even Communist governments. So, I think I understand competing interests, which I think a lot

of this is about, regulatory processes and, certainly, I am used to red tape.

As was mentioned, salmon start their lives in riffles in the upper river reaches. Over the decades of my career, we have spent tens of millions of dollars restoring these riffles so that more fish can spawn so we could provide or produce more baby salmon.

We soon realized that these baby salmon had a perilous journey downstream to the ocean, due to water diversion. So, we spent two decades spending hundreds of millions of dollars screening diversions. My first job in fisheries was the Glenn-Colusa Irrigation District, which was a fish screen that cost $50 million to build. Of course, that was the largest one, I believe, in northern California.

Additionally, we have spent tens—and I am not an economist, but I would even say maybe hundreds—of millions of dollars on various studies and monitoring. We have life history monitoring, behavior studies, habitat use, predation, influence of flow on survival. So, where are we now? I would say we have a couple of decades gone, and we have certainly spent billions of dollars. And I think the spending continues, and I don't think it is going to stop or slow down in the near future.

Additionally, we have a contentious and costly fight for water, and I think we are always going to have that in the state of California, as well. Yet native salmon continue to decline, and hatchery fish continue to increase, as was noted. It is estimated that 90 to 95 percent of the fish, the salmon in California, are currently hatchery fish.

I think an objective person, and certainly an economist, would say that this has probably been a pretty dismal failure, considering how much money we have spent and the state of the system we have today.

The one thing that I think most Central Valley biologists would agree on today, at least the field biologists that I deal with on a regular basis, is that predation is a huge, huge, problem, and the more we look, the more we see, the more we learn about this.

NMFS, in their 2009 recovery plan for salmonids, said that reducing abundance of striped bass and other non-native predators must be achieved to, and I quote, "prevent extinction or prevent the species from declining irreversibly." Now this was NMFS's 2009 recovery plan for salmonids. So I don't know how I would argue against predation being a problem.

The California Department of Fish and Wildlife later admitted this. They had to be sued in 2008 or 2009. In 2011, they settled out of court, and admitted that this was a problem. We still spend billions on research, monitoring, restoration, but this is really all so we could feed the predators downstream. These are expensive salmon that we are producing upstream and feeding to downstream fish.

Perplexingly, under the Central Valley Project Improvement Act (CVPIA) there is a legal requirement to double the striper population, similar to the anadromous salmon population. Perhaps the only invasive species in the world that has legal protection, and certainly the only one in the world that has a legal requirement to double its population. I did not look extensively, but I don't know of another situation like that. So, it is not often that we have a

free, fast, and effective solution to any problem, especially an environmental problem. But I do believe predator control is one such solution, and I think we need to implement what the state of California agreed to in their settlement lawsuit in 2011, but have yet to do.

Simple, straightforward changes to California's sportfishing regulations are needed. We either need to liberalize or completely remove harvest limits on striped bass and other non-native fish. This will increase harvests of these fish, decrease predator abundance, and ultimately increase survival of out-migrating salmon, steelhead, and other protected fish.

Thank you. I look forward to elaborating on my comments further.

[The prepared statement of Mr. Demko follows:]

PREPARED STATEMENT OF DOUG DEMKO, PRESIDENT, FISHBIO, CHICO, CALIFORNIA

The Overview: A Policy of Predation

California resource agencies sink tens of millions of dollars every year into a failing effort to protect native and endangered fish species, while also bolstering introduced top-level predators that are decimating the very fish they are required to maintain. Without question, California's capital and time investments rival other successful fish recovery programs exemplified in the Pacific Northwest and Columbia River, but long-standing conflicting statutes and policies create fatal flaws that hinder native fish recovery. Decades of research, declining populations, and confused policies show that management of California fisheries is painfully ineffective. Resource agencies have acknowledged, but not addressed the problems.

Instead of addressing the issue of predation, policy mandates to maintain non-native gamefish (i.e. predators) and placate the problem by producing more hatchery salmon have resulted in further deterioration of wild stocks and an alarming reliance on hatcheries. The Central Valley Project Improvement Act (CVPIA) of 1992 actually *requires* protecting and improving both introduced predatory striped bass and salmonids—an illogical contradiction of science and policy. Fisheries managers have used hatcheries as a band-aid to partially cover a gaping wound. It is acknowledged that supplementing wild salmon populations with hatchery fish is currently necessary to ensure future native fish populations, but hatchery fish are a poor substitute to wild fish. These policies result in both flawed economics and science. For example, increased flow appears to be the popular red herring for recovering native fish populations, but scientific studies continue to indicate that water releases from rim dams are no silver bullet: more water doesn't equal more fish (or it's impact on survival is small enough as to be difficult to establish). There is strong evidence that high flows in wet years are beneficial to fish, but recent studies have not been able to establish a relationship between smolt survival and river flow, within the managed flow range. Both the problem and the solution are evident, but the question is whether appropriate action will be enacted.

The Problem: Ignoring Unnatural and Excessive Predation of Native Fishes

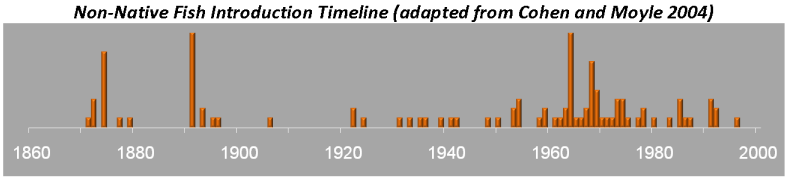
The overwhelming majority of predation on juvenile Chinook salmon is the result of non-native predators that were intentionally stocked by California Department of Fish & Wildlife. Most of the non-native fish species (69 percent) in California, including major predators, were intentionally stocked by CDFW for recreation and consumption beginning in the 1870s.

Numerous studies conducted by both agency and private researchers documented that predation poses a serious threat to juvenile salmon in California. A variety of non-native gamefish species, such as striped bass, largemouth bass, smallmouth bass, white catfish, black crappie, and spotted bass, prey on juvenile salmon in the San Francisco Bay-Delta and its watershed. (Shapovalov 1936; Stevens 1966; Thomas 1967; Pickard et al. 1982; Merz 2003; Gingras 1997; Tucker et al. 1998; Nobriga and Feyrer 2007). However, only recently has the existing body of science on predation been recognized among fisheries managers as a *major* source of juvenile salmon mortality.

> *By virtue of their abundance, habits, and size, predation by striped bass has been implicated as a substantial contributor to the poor survival of young salmon used in experiments to estimate reach- and site-specific survival rates through the Delta and in the Sacramento River (Bowen et al. 2009; Gingras 1997; MacFarlane et al. 2008; Michel 2010; Newman and Brandes 2010; Perry and Skalski 2008; Perry and Skalski 2009; Tucker et al. 1998; Vogel 2010; Vogel 2011). By plausible extension, listed salmon (and steelhead) also suffer poor survival rates due to predation, including predation by striped bass. (CDFW 2011)*

It has now become clear that predation may significantly limit the success of salmon recovery efforts (NMFS 2009b; Dauble et al., 2010). *The NMFS Draft Recovery Plan (2009b) for Chinook salmon and Central Valley steelhead considered "predation on juveniles" one of the most important specific stressors*. Further, reducing abundance of striped bass and other non-native predators must be achieved to "*prevent extinction or to prevent the species from declining irreversibly*" (NMFS 2009).

Non-Native Fish Introduction Timeline (adapted from Cohen and Moyle 2004)



As CDFW noted on the first page of their lawsuit settlement report in 2011 recommending revisions to sportfishing regulations:

> *While predation by striped bass is only one of numerous stressors on the listed species, by previously stocking striped bass and by enacting the striped bass sportfishing regulations currently in effect, the Department of Fish and Game (Department) and the Fish and Game Commission (Commission) may have inadvertently contributed to this stressor by helping establish and maintain the current population of predatory striped bass. More importantly, this particular stressor not only has roots in the actions of the Department and the Commission, but standard fisheries management practices indicate it may be alleviated, at least in part, by further action on the part of the Department and Commission. (CDFW 2011)*

Further, also on page one:

> *Although studies of striped bass predation show each of the listed species to constitute a relatively small part of the striped bass diet, and although the actual level of striped bass predation on these species is unknown and likely unknowable, the enormous volume of fish (up to 110 million pounds annually) consumed by striped bass and the widespread distribution of striped bass within the geographic range of the listed species indicate the impact of striped bass predation on the listed species could be substantial; and . . .*
>
> *The recreational fishery for striped bass is very popular, and many anglers will harvest substantially more striped bass if they are allowed to keep smaller fish. (CDFW 2011)*

Despite the documented predation of such species on native fishes, high densities of introduced top predators are not being controlled, but in some instances enhanced. For example, changes in Federal statutes in the CVPIA required a doubling of natural production of Central Valley populations of anadromous fish within 10 years. Non-native striped bass were included, thus creating competing goals of doubling both salmon and their introduced predators that were enacted in 1992. Hatchery outplanting of striped bass ended in 1992 (Kohlhorst 1999). While it is clearly stated that predation is a significant impact on salmonids, it is also evident that policy to date has resisted any effort to challenge the 'very popular' striped bass fishery.

The History: Research Identifying a Growing Problem

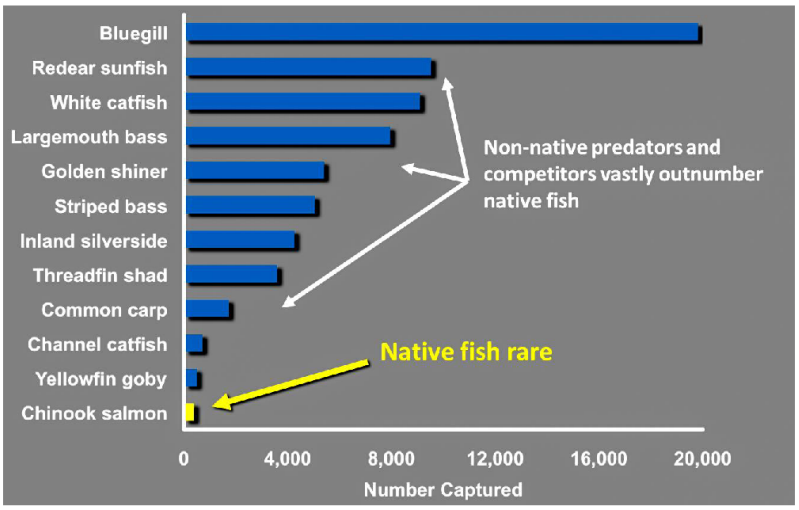
The issue of predation did not occur overnight and the research to show its effects has progressed over decades. For instance, in the San Joaquin Basin between 1986 and 2006, paired releases of large groups of marked young salmonids (smolts) were made near the upper extent of spawning and near the mouth of several tributaries of the San Joaquin River: the Stanislaus, Tuolumne, and Merced rivers. Survival of fish in these tributaries was estimated based on the numbers of tagged smolts from the upper group relative to the lower group that were later recovered in the San Joaquin River at Mossdale. These mark-recapture studies provided the first direct estimates of very poor tributary survival in some years.

Rotary screw trapping to monitor juvenile salmonid out-migration from the Stanislaus River began in 1995, and comparisons of estimated abundance at an upstream site relative to a downstream site near the confluence with the San Joaquin River indicate survival is poor in many years. This data is valuable because it provides estimates of survival for naturally produced juvenile salmon of all life stages migrating volitionally throughout the varying conditions observed during each migration season.

In 1998 and 1999, a pilot study using radio telemetry in the Stanislaus River was the first in the San Joaquin basin to directly confirm predation by electroshocking a large striped bass and retrieving a radio tag (from a tagged, digested salmon smolt) from its stomach. This early research was important for establishing that: predation was occurring; suspected predation was occurring more frequently in substantially altered habitats, such as mine pits and deep scour holes; and non-native predators were present and relatively abundant in the Stanislaus River, even under the wetter hydrology observed in the years studied.

The Stanislaus River counting weir, which has been in operation since 2003, was the first of its type used in the Central Valley. Weir monitoring has documented migration characteristics of adult striped bass, and has demonstrated that striped bass live in the river year-round and are abundant, especially in dry years (when salmonids are most stressed).

In 2012, after more than 15 years of juvenile out-migrant survival studies and monitoring indicating that predation is a major problem in the Stanislaus River, the USFWS estimated smolt survival in the river using radio telemetry. The survival estimate of 7 percent in 2012 was much lower than the 40–60 percent previously estimated by mark-recapture studies conducted by CDFW.



Abundance of fish captured in a decade of Delta sampling shows native fish (yellow) are rare. Only eight native species were captured, none of which represented more than 0.5% of the total catch. Data from Feyrer and Healey 2003.

Differences in catches between upstream and downstream rotary screw traps in the Tuolumne River between 2007 and 2012 also indicate high losses, ranging from 76 percent to 98 percent. In 2012, a study of rotary screw trap monitoring on the Tuolumne River documented 96 percent mortality of juvenile Chinook out-migrants between these two trapping stations. As part of the FERC relicensing of the Don Pedro Project, a predation study conducted later the same year found that, based on observed predation rates and the estimated predator abundance between the traps, it is plausible that most of the losses of juvenile Chinook salmon between the two traps could be attributed to predation by non-native predatory species. A second year of more comprehensive investigation of predation in the Tuolumne River was planned for 2014 following on the heels of this ground-breaking work completed in 2012; however, permits have not been issued by CDFW.

In addition to the evidence in the Stanislaus and Tuolumne rivers, the Vernalis Adaptive Management Plan (VAMP) investigated the relationship between salmon smolt survival through the San Joaquin Delta and flow, exports, and operation of the Head of Old River Barrier between 2000 and 2011. A peer review (Dauble et al. 2010) of this work and the results of similar, earlier studies, concluded that "high and likely highly variable impacts of predation, appear to affect survival rates more than the river flow." Since 2003, smolt survival through the San Joaquin Delta has consistently been less than 12 percent, while flows at Vernalis ranged between 2,000 cfs and 27,000 cfs.

During spring 2014, a predation study in the lower San Joaquin River near Mossdale was conducted by NOAA Fisheries. Predators were found to outnumber Chinook salmon by a ratio of roughly 200 predators for every 1 Chinook salmon. Similar to recent studies conducted by NOAA Fisheries on the Sacramento River, live Chinook salmon were tethered to quantify the frequency of predation events. On some nights, 100 percent of the tethered Chinook salmon were preyed upon within one hour, indicating much heavier predation rates in the San Joaquin River than observed during the studies conducted on the Sacramento River. Out of 2,064 deployments of Predation Event Recorders, there were 672 predation events (15–60 percent per reach). Of the positive identifications of predators (121 had video footage), striped bass were responsible for 99 percent of the predation (Hayes et al., 2015).

Similar to previous work in the tributaries, this study confirmed that low survival rates could be explained by predation by introduced fish species such as striped bass and largemouth bass. This more recent work supports the large amount of evidence that suggested that predation was the primary source of mortality of migrating juvenile salmonids. The best estimates averaged about 30 percent (range 3–99 percent) from previous studies (Gingras 1997; Hanson 2009; Merz 2003; NMFS 2009).

The Response: What Response?

A large body of evidence has been accumulated since the 1990s that all points to the conclusion that predation by non-native predators is having large impacts on sustainability and recovery of native fish species (see previous section). While predation impacts are not the sole reason for declines in native species in California, they remain an important and largely unresolved topic in managing fisheries. Fisheries management in California to this day continues to attempt to manage all fish species in the Central Valley on approximately equal footing—that is, attempting to manage introduced sportfish (i.e., promote striped bass fishing opportunities) while at the same time managing for sensitive and native species (e.g., Chinook salmon, steelhead, and Delta smelt), most of which are federally protected. This highlights the conflicting fisheries management goals of government agencies, which in turn, create and promote conflicts between various stakeholders in the state. In the past decade, the response by the CDFW to the predation issue has largely been the result of litigation and the subsequent settlement agreement (Table 1). Two CDFW workshops were held to address predation, but little action resulted from them, even though decades of research and examples of successful predator control programs were available for review and consideration. The CDFW settlement agreement only resulted in a relatively small funding opportunity ($1 million) to study predation in the Bay-Delta; no changes in sportfishing regulations, and, to date, no meaningful actions of any kind have been taken to accept or address the problem.

Table 1. California Department of Fish and Wildlife Predation Response (1990s to Current)

Year	Action
1992	Formal stocking of striped bass ended due to concerns on impacts to winter-run Chinook salmon.
May 2006	Report from predation workshop to summarize current state of knowledge on predation associated with southern Delta pumping facilities.
2008	2008 striped bass lawsuit filed.
April 2011	Settlement required CDFW to: (1) Develop proposal to modify striped bass sportfishing regulations (2) Set aside $1 million for predation research
November 2011	Proposal to modify regulations released.
February 2012	Fish and Game Commission rejects pursuing proposal to modify regulations.
July 2013	CDFW holds second predation workshop in an 8-year period to summarize current state of knowledge on issue.
September 2013	Expert panel issues report from predation workshop finds that primary research needs to include estimation of predation risk and exploitation risk requiring accurate estimates of both predator and prey abundance encompassing spatial and temporal variation.
September 2014	Request for Proposals notice released $1 million to fund predation research. Proposals were due November 2014 with funding to be awarded in spring/summer of 2015.
February 10, 2016 *(Today)*	Despite continued pressure on CDFW through various mechanisms (through research and monitoring studies and through the litigation and settlement process), no action has been taken to address predation or predation impacts in any meaningful manner. Perhaps more importantly, *striped bass sportfishing regulations have remained unchanged.*

Simple and straightforward changes to California sportfishing regulations should be implemented to remove harvest limits and size limits on striped bass and other non-native predators. Sportfishing regulation changes could decrease the overall numbers of striped bass and other predators that consume the most salmon per capita. The change would only be one additional tool, among many already required by law (e.g., habitat restoration, water management, etc.), to aid in the long-term conservation and persistence of native fish species. A change in policy on this issue is not unprecedented. In Fall of 2015, fisheries managers in both Oregon and Washington removed many harvest, season, and size limits for warm water species (e.g., largemouth and smallmouth bass, walleye, catfish, bluegill, crappie, other sunfish, and northern pikeminnow, among others). The changes in regulations are most drastic on the Columbia River system in order to further support salmonid population recovery. The purpose of the regulation change was to lower the rate at which non-native predators prey on salmon and steelhead smolts, and to simplify complex fishing regulations. More importantly, fisheries managers in both states sent a clear message they are committed to the continued persistence of native fish species. A similar policy change in California, coupled with focused removal and suppression efforts, could lead to improved survival conditions for native species as has been demonstrated on the Columbia River (see section "The Solution").

The Economics: Salmon Have the Greatest Impact

The economic contribution of salmon in California is significant. Viewing salmon through the prism of economics allows one to see not only the cultural and iconic value of the fish, but also the tangible and significant economic contribution to California. This is an important consideration in the ongoing discussion about the effects of predation and the many millions of dollars spent each year on monitoring, regulations, research, hatchery supplementation and conservation projects for salmon.

Overall, California's marine recreational and commercial fisheries for all fish species have more economic impact than any other West Coast state, including Alaska (NMFS 2013). The greatest economic impact to California comes from commercial salmon fishing; however, recreational in-river harvest provides the greatest value per fish. The striped bass fishery also provides an economic benefit to the state, but

at the cost of high predation to valuable salmonids. The cost for salmon recovery due to striped bass may offset any perceived value. Salmon represent the primary fisheries target species and economic driver. California's commercial salmon fishery is small compared to other West Coast states, but likely persists as a result of the premium price of local commercially harvested salmon.

The 2013 recreational salmon fishery in California produced an overall economic impact of approximately $104.4 million for the state, while the commercial salmon industry produced approximately $244.4 million (NMFS 2013; PFMC 2014; Ransom 2001). In 2010 (most recent available estimate), the California striped bass fishery had an estimated economic impact of $28.7 million (CDFW 2011). The striped bass fishery in California is popular, based on harvest and angler hours. However, the economic impact from striped bass angling is considerably lower than the recreational salmon fishery: a striped bass harvested in-river by a recreational angler provides an estimated economic impact of approximately $494, while an in-river harvested salmon offers an impact of approximately $1,176 (Ransom 2001; CDFW 2001). Increasing striped bass harvest in California could lower predation pressure on juvenile salmonids, increase juvenile survival rates, and significantly reduce costly ongoing salmonid population recovery effort. As the economic value of in-river salmon sport harvest is considerably higher than that of striped bass, there would be a net economic benefit.

These estimates of economic impact are conservative compared to other estimates that are available. The American Sportfishing Association (2010) reported that the 2009 closure of the salmon fishery in California cost the state $1.4 billion in economic activity and over 23,000 jobs. The same study estimated that a full recovery of California's Chinook salmon runs could provide $5.7 billion in economic activity and 94,000 jobs for the state.

The Hatcheries: Adding Fish is Not a Long-Term Solution

Considering the staggering economic impact of the salmon fishery, it is logical to assume that hatcheries are an easy solution to the problem of predation. California's anadromous fish hatcheries produce upwards of 50 million fish per year. In the Central Valley alone, the cost of this production totals nearly $9 million dollars annually (HSRG 2012). However, many would argue that hatcheries are simply treating the symptoms, and not the causes, of salmon decline. It may seem illogical that hatcheries could actually undermine the very species they are meant to proliferate, yet many studies have raised concerns about hatchery practices, backed up by empirical evidence.

Multiple fish hatcheries were constructed in California's Central Valley to mitigate for lost spawning habitat created by dams (Shasta, Folsom, Oroville, Camanche, and New Exchequer) built for both the Central Valley and State Water Projects. Over time, fall run Chinook salmon propagated at the five Central Valley hatcheries have comprised increasing proportions of the fishery, and best available estimates indicate that approximately 90 percent of the current commercial catch is composed of hatchery fish (Barnett-Johnson et al. 2007; Kormos et al. 2012; Palmer-Zwahlen and Kormos 2013; Palmer-Zwahlen and Kormos 2015). Clearly, without artificial supplementation, there would not be a commercial salmon fishery currently in the state.

Adult Hatchery Chinook Salmon Captured in the Stanislaus River

Hatchery fish are inferior to their wild counterparts for numerous reasons. Overwhelming evidence indicates that hatchery fish have much lower survival rates once released in nature (e.g., Waples 1991; Unwin 1997; Kostow 2004). Unlike wild fish, hatchery fish are selected for traits that allow them to perform well in a captive environment, but are maladaptive in the natural environment. Hatchery fish are

raised in predator-free concrete raceways and fed from above by automatic feeders and, consequently, are less able to avoid predators and feed sufficiently once outside of the hatchery. Because of their reduced genetic diversity, hatchery fish are more susceptible to diseases and are less able to adapt to new environmental conditions, such as freshwater flow extremes and warmer ocean temperatures. Indeed, research has demonstrated that hatchery salmonids have relatively small brains and slow sprint swimming speeds, and both factors likely contribute to their relatively low survival rates observed in nature.

Salmon are famous for their ability to home back to their birthplaces to reproduce after traveling hundreds to thousands of miles in the freshwater and marine environments. The precise mechanism(s) for salmonid homing are not completely known, but are believed to result from juveniles imprinting on odors during downstream migrations, with subsequent recognition of olfactory cues by adults during prespawning upriver migrations (Quinn 2005). Homing promotes adaptations to unique local environmental conditions and increases the likelihood that adult salmon will find mates and adequate spawning conditions. Because of homing, each population has developed local genetic adaptations over time that best fit the unique conditions of their environment.

Over time, juvenile hatchery salmon have been trucked farther downstream and released in larger numbers (Huber and Carlson 2015). Fish are released en masse in the Sacramento-San Joaquin Delta and San Francisco Estuary in order to boost survival rates by satiating predators, such as striped bass, and limiting exposure to harmful water quality by encouraging rapid emigration to the sea. Reduced mortality of juvenile fish has resulted in higher contributions of adult fish to the commercial and recreational fisheries overall. However, the lack of olfactory imprinting in hatchery fish has promoted exceptionally high rates of adult straying (approximately 70–80 percent compared to natural rates of <1–10 percent) from natal rivers (Sholes and Hallock 1979; JHRC 2001; Hendry and Stearns 2004; Kormos et al. 2012; Palmer-Zwahlen and Kormos 2013; Palmer-Zwahlen and Kormos 2015). According to experts, this lack of population structure is a "cause for serious concern" (Williams 2006). Alarmingly high straying rates are incompatible with the objective of promoting diverse and locally adapted Central Valley salmon populations.

The Central Valley fall-run Chinook stock complex is genetically homogenized (Williamson and May 2005). The lack of any discernable population structure over such a vast geographic area is unique and due, in part, to off-site hatchery release practices (Garza et al. 2008) which have promoted straying. The alarmingly high rates of adult straying is a concern to both conservationists and hatchery managers. Conservationists are concerned that hatchery strays will interbreed with wild fish and reduce the genetic diversity of wild populations. Reduced genetic diversity will make the remaining wild stocks more vulnerable to future environmental change because evolution can proceed only when there is sufficient genetic variation to select from. Hatchery managers are concerned that egg quotas will not be met if too many fish stray away from hatcheries. This occurred during the 2008–2009 salmon fishery collapse for both the Mokelumne and Merced River hatcheries.

The increasing reliance on hatcheries to support fisheries is trading short-term gains for long-term losses. The result is market failure, such as that observed during the fishery collapse in California from 2008–2009, when the commercial and recreational salmon fisheries were completely closed and Federal and state hatcheries were not able to meet production goals. Substituting hatchery fish for wild fish is a risky long-term strategy for both economic and conservation reasons; heavy reliance on hatchery fish is expensive and requires a constant source of funds to sustain the fishery. Wild salmon populations are self-sustaining and require no such investments from humans as long as the habitat capacity of natural areas is sufficiently productive.

Central Valley salmon hatcheries have two main purposes: to sustain commercial fisheries and to reduce pressures on naturally spawning (wild) salmon. With the benefit of 70 years of hindsight, they have arguably failed to achieve both goals. Hatchery reform must include revisions of practices and policies so they are more consistent with restoration objectives. It is the policy of the California Fish and Game Commission that "salmon shall be managed to protect, restore, and maintain the populations and genetic integrity of all identifiable stocks . . . artificial production shall not be considered appropriate mitigation for loss of wild fish or their habitat" (California Department of Fish and Game Commission, amended 5/9/2008; http://www.fgc.ca.gov/policy/p2fish.aspx). According to USFWS (2009), "the 21st century will demand a shift from managing individual resources to sustaining species, populations, and ecosystems." Accordingly, the California Hatchery Scientific Review Group (CAHSRG 2012) recommends a cessation of the trucking program because straying must be minimized in order for local adaptations to re-

emerge. On-site releases must be favored, but in order to achieve success, alien causes of high in-river mortality rates, such as predation by non-native striped bass, need to be remedied.

The Solution: Direct Support for Predator Management

Predation run amuck is not a new issue and there are examples of successful solutions. One long-running example comes from the Pacific Northwest, a region highly regarded for its advanced fisheries solutions.

Northern pikeminnow are indigenous to the Columbia River, but they were not prevalent before the construction of the hydroelectric Federal Columbia River Power System. Reservoirs created by the hydropower system provided excellent slack water habitat for pikeminnow, and as a result their population in the lower Columbia and Snake Rivers flourished. Northern pikeminnow are voracious predators and salmon smolts comprise a large portion of their diet (Sauter et al 2004). These native predators now consume millions of salmon and steelhead each year in the lower Columbia and Snake River systems.

The Northern Pikeminnow Management Program (NPMP) was established in 1990 in an effort to reduce predation by northern pikeminnow on juvenile salmon and steelhead as they emigrate from the lower Columbia and Snake Rivers to the ocean. The goal of the program is not to eliminate northern pikeminnow, but to reduce their average size and decrease the number of larger, older fish that are known to be highly predacious. Since 1990, the Bonneville Power Administration (BPA) has sponsored the Northern Pikeminnow Sport Reward Fishery Program in the lower Columbia River and a portion of the Snake River (from the mouth to Hells Canyon), offering cash to registered anglers for each northern pikeminnow they catch measuring 9 inches or longer. Site-specific gill netting and dam angling were also part of the NPMP, but were less efficient than the sport reward program and were discontinued in 2002 and 2006, respectively.

Since 1990, the BPA has paid anglers to remove more than 3.9 million northern pikeminnow from the Columbia and Snake Rivers (annual average of 175,000), reducing predation on juvenile salmon by an estimated 40 percent. The successful predator removal program equated to saving 4–6 million salmon smolts that would have otherwise been eaten. Not only did the program save salmon, it was extremely cost-effective. Of the program's $2.9 million budget, it is estimated that $1.4 million was returned to local economies from angling activity. Further, researchers estimated that the increased salmon resulted in $2.7–$9.9 million dollar benefit for economies from California to Alaska.

The Outcome: You Can't Get There From Here

While the public or outward perception of CDFW may appear as though the agency is actively addressing the predation issues through publicly visual workshops, the agency has privately thwarted efforts by private interests (i.e., water rights holders) to study the predation problem on their affected rivers and streams, and to collaboratively work with all stakeholders toward a solution. One such study was proposed in 2013, when FISHBIO, on behalf of water users, proposed to test whether reducing the number of non-native predators increases survival of juvenile Chinook salmon migrating through the lower Stanislaus River. To address this hypothesis, the overall goals of the Stanislaus River Predator Suppression Project were to (1) substantially reduce the abundance of non-native predators in the lower river by both preventing immigration of non-native predators into the river and removing existing non-native predators; and (2) to evaluate survival patterns of juvenile Chinook salmon during the same period. Other proposed predation studies in California, which were supported by Federal agencies and also fully funded by water rights holders, have been delayed, blocked, or otherwise not allowed due to 'permitting issues,' often with little scientific or technical justification.

While there is no guarantee that active predator management (i.e., predator suppression or removal projects) in California's Central Valley will substantially improve conditions for native species, it is guaranteed that continuing with the status quo will hinder or completely prevent species recovery and sustainability of native species. The effects of predation are undoubtedly an important driver in population dynamics of native fish populations in the Central Valley, and the hesitation to enact meaningful regulations and actively study the issue is troublesome. In addition, the lack of focus on such an important topic does not represent a comprehensive management strategy to manage a unique suite of native fish species in California. Innovative solutions to species recovery using a variety of tools (e.g., habitat restoration, targeted or passive predator management) should be implemented without delay to promote the survival and sustainability of California's iconic native species.

The Presenter: Background and Experience

My name is Doug Demko. It is my pleasure to share this information and my experience with you. I am the President of FISHBIO (www.fishbio.com), a fisheries consulting firm with over 40 U.S. and international employees that specializes in fisheries research, monitoring, and conservation. I have been researching freshwater and anadromous fish in California for 25 years, including studying the potential impacts of dam and hydropower operations on fish populations. I have led research and monitoring efforts on the Stanislaus River since 1991, and currently work on the Calaveras, Stanislaus, Tuolumne, Merced, and San Joaquin rivers for a number of stakeholders. I have had the privilege of providing expert testimony on the impacts of flow on juvenile Chinook salmon and steelhead migration and survival in the San Joaquin River Basin to the State Water Resources Control Board on several occasions. I also prepared a brief on California Delta Chinook salmon predation losses for U.S. Senator Dianne Feinstein prior to a Congressional Meeting with House Speaker Pelosi and Senator Boxer on Central Valley fish and water issues, and twice provided expert testimony on the extent and causes of losses of juvenile Chinook salmon and steelhead in California's Central Valley tributaries and Delta to California State Legislature Congressional subcommittees. In addition to my work in the United States, I also direct FISHBIO's international research, including our office and staff in Lao People's Democratic Republic, where we work extensively in the Mekong Basin. Our research includes evaluating fishery and food security issues relating to hydropower development. FISHBIO has received grants from the U.S. State Department, U.S. Geological Survey (USGS), World Wide Fund for Nature (WWF), International Union for the Conservation of Nature (IUCN), Critical Ecosystem Partnership Fund, Wildlife Conservation Society (WCS), The Asia Foundation, and others. I am privileged to work for and partner with many leaders in global conservation efforts.

[This document and references cited can be viewed at www.fishbio.com/predation_testimony.]

QUESTIONS SUBMITTED FOR THE RECORD BY REP. JARED HUFFMAN TO MR. DOUG DEMKO

Question 1. Is there any evidence you can share demonstrating a relationship specifically between predator abundance and salmon returns in California's Sacramento-San Joaquin River Delta?

Answer. Thank you for the question and the opportunity to respond. As far as I am aware, there is no demonstrated relationship specifically between predator abundance and salmon returns to the Sacramento and San Joaquin Rivers, simply due to lack of predator abundance monitoring by the California Department of Fish and Wildlife (CDFW). Regrettably, effective fisheries abundance monitoring is not a priority for CDFW, especially for non-native species on a large geographic scale (i.e. lower tributary reaches and Delta), and this prevents us from evaluating a possible relationship between predator abundance and salmon returns.

As we discussed at the hearing on February 10, 2016, data from recent monitoring and focused research all strongly suggest that predation is a significant factor in reducing survival of juvenile salmon during their seaward migration, and subsequently reducing recruitment to the ocean and to spawning age. Recent predation studies have been conducted on the Tuolumne, Mokelumne, and San Joaquin Rivers (FISHBIO 2012; Sabal 2014; Demetras et al. 2016). FISHBIO (2012) used consumption rates and predator abundance data to estimate the potential loss of juvenile Chinook from predation in the lower Tuolumne River, which exceeded 90 percent loss. Monitoring data from rotary screw traps have indicated that losses of juvenile Chinook salmon have ranged between 75 percent and 95 percent from 2007 to 2012 corroborating the estimate from the study (FISHBIO, 2012). Sabal (2014) demonstrated that survival of juvenile Chinook salmon at a known predatory hot spot was improved on average 25–29 percent after predator removals. On the San Joaquin River, Demetras et al. (2016) estimated that cumulative index survival of tethered Chinook salmon through a 1-kilometer reach was as low as 0.72 (out of 1). In the freshwater environment, many factors can affect survival of juvenile salmon including flows, water temperatures, predation, and disease, among others. Many of these factors are intensely managed in the Central Valley currently, but rarely have they resulted in recovered populations of Chinook salmon. The exception is predation, which to date, has not been addressed in a meaningful manner in the Central Valley. Therefore, reducing the predation pressure on juvenile salmonids should be

considered an additional management option, among many already currently used, to aid in the recovery and sustainability of Chinook salmon populations.

Since the hearing on February 10, the Washington Department of Fish and Wildlife removed fishing restrictions for bass, walleye and channel catfish from the mouth of the Columbia River 545 miles upstream to Chief Joseph Dam. The deregulation is consistent with fishing modifications in effect since 2013 on the upper Columbia River, and with those approved last year for boundary waters shared by Washington and Oregon further downstream. The main goal of deregulating the fisheries for bass, walleye and channel catfish is to increase the harvest of these species, thus reducing predation on juvenile salmon and steelhead that are listed for protection under the Federal Endangered Species Act.

Dr. FLEMING. Thank you, Mr. Demko. I believe we are now ready for questions. Therefore, I yield myself 5 minutes for questions.

First to you, Mr. McCormack. Your testimony makes a number of recommendations, including—and this is a quote, word for word—"providing clear and respectful deference to endangered species when in conflict with non-endangered or protected species." Clearly, we have Federal laws that are acting in contradiction to each other in some cases. How should Federal agencies balance these competing demands, particularly when they are constantly being threatened by lawsuits?

Mr. MCCORMACK. Thank you for the question. I think it is appropriate when we work together—with the inter-agencies working together, staffs working together, looking at the matrix that has developed. And, of course, I am not a scientist. So, we will leave it to them for the specifics. But working with those numbers, and working with the effects, and having them sign off between agencies so that they all have input on how this legislation or how things would affect one another, I think would be a good recommendation.

Dr. FLEMING. OK, thank you.

Mr. Demko, you mentioned the fish doubling goal for both striped bass and salmon in the Federal Central Valley Project Improvement Act as direct contradictions where doubling the population of the non-native striped bass is undermining the same goal for salmon. Do such goals make sense?

Mr. DEMKO. Well, from my opening statement, obviously, I don't believe so. I don't see, especially considering the decades that we have put into salmon recovery, all of the efforts, all of the money that gets spent to protect and make more salmon, only to have the baby salmon migrate downstream and be eaten by non-native predatory fish.

I recognize that it is a popular sport fishery, but it is just that. It is a sport fishery. And a lot of money, time, and effort—decades have gone into restoring native salmon populations. I think that it is now obvious that striped bass and other non-native predators are a hindrance to those efforts.

Dr. FLEMING. So what would make sense to improve that balance?

Mr. DEMKO. Let's look for a free, fast, and effective solution. As I mentioned, there are not too many times in nature—and I have never encountered one in my career, where we are trying to solve a problem and there is a solution in front of us, at least a partial solution. I am not saying it is a complete or full solution, but when

there is an opportunity in front of us to make a substantial improvement, or substantially improve the number of baby salmon that are surviving to the ocean by just simply changing the law to allow striped bass and other predators to be harvested.

Dr. FLEMING. Would it be wise to strike the fish doubling goal for the striped bass?

Mr. DEMKO. Yes, I think it makes total sense as a first step to change the CVPIA doubling goal.

Dr. FLEMING. OK. This question is for Mr. McCormack and Mr. Demko.

Mr. Grossman's testimony questions whether the Bonneville Power Administration's program on controlling the northern pikeminnow has been successful. His questioning of that program implies that future predator control programs may not be successful. Yet your testimonies use pikeminnow control as an example of success. Has this program had positive effects on salmon populations?

Mr. MCCORMACK. I would say, yes, it has saved thousands of smolts. So, yes, it has been effective.

Dr. FLEMING. Mr. Demko?

Mr. DEMKO. OK, two comments on that. Number one, a paper published and presented to the Pacific States Marine Fisheries Commission in 2004 found it to be cost effective. And this program we are talking about is a sport fishery, so they pay people, there is a reward program to harvest pikeminnow. They found it to be cost effective. They said it reduced predation as much as 35 percent. Thirty-five percent by removing one fish, and that was a native fish, and I think less, much less, of a problem than we have in California.

The $2.9 million budget contributed $1.4 million to local economies. When you looked at the number of salmon that actually grew up and returned, it was between a $2.7–$9.9 million return to economies all up and down the West Coast.

On top of that, they found that other predators did not move in and compensate. So, we were not leaving a niche open that allowed other predators to step in. And if I can read here from a press release from the Army Corps of Engineers, the Bureau of Reclamation, and BPA, the Bonneville Power Administration. This was on September 28, 2012. "Sport anglers removed approximately 155,000 pikeminnow from the Columbia last year. The sport reward program has reduced pikeminnow predation on juvenile salmon by roughly 40 percent since 1990. The Action Agencies continue to focus on controlling predation by native and non-native species."

So, to me, it is clear that this program in the Pacific Northwest has been economical, efficient, and effective.

Dr. FLEMING. It sounds like a win-win-win. People get to fish, they get paid in some cases to fish, and you end up getting more salmon.

Mr. DEMKO. Yes.

Dr. FLEMING. That is lovely. My only other question is are these fish edible, the predator fish?

Mr. DEMKO. Yes, they are.

Dr. FLEMING. OK, that is four wins. So, with that, I yield to Mr. Huffman.

Mr. HUFFMAN. I was not aware that pikeminnow were worth eating, but perhaps I live and learn.

Dr. Grossman, I appreciated your testimony about the important distinction between ultimate causes of salmon mortality and proximate causes. Perhaps you could elaborate a little bit on that.

I also appreciated that you alluded to the fact that much bigger stressors are the ultimate causes of the demise of salmon in a place like California, and that we have to include those in our consideration. We are not really allowed to have that conversation in this forum, to talk about seriously degraded habitat and the need for flows. We are continually having to reprove that fish need water while we talk about these other things.

But the whole conversation reminds me that about a century ago, wildlife officials in Alaska, who had no problem with canneries blocking off the entire mouths of rivers, and taking almost 100 percent of the returning salmon for the industry, thought that the solution to declining salmon populations was to offer a bounty on bald eagles. And there are certainly shadows of that conversation in the one that we are having here today.

So, I wanted to ask you about your analysis of previous predator control approaches, and frankly, whether there have been many genuine success stories involving predator control.

Dr. GROSSMAN. Thank you. All right. A complex question, right? As you have alluded to in your statement, especially in the Sacramento-San Joaquin Delta Region, we have basically every environmental problem that you could find that affect fish. We have contaminants, we have habitat alterations and habitat destruction, we have water exports. And everybody in this room needs water, and fish need water, right?

So, I guess I would like to address a couple of questions that were just brought up. The first is the aspect of evaluating whether or not previous predator control strategies have been successful. In some cases, it is an apples-and-orange kind of question. When evaluations are made on whether predator control is successful or cost effective, the standard that it is judged by is how much it costs to remove a given number of predators. And if the managers agree that the cost per predator removed is worth it, and the state can pay it, then that is deemed successful and cost effective.

In my testimony, I spent a fair amount of time talking about ultimate and proximate causes. I hope I made the point that predation frequently is not the ultimate cause of mortality. So, Mr. Huffman, you made the comment earlier about the fish ladders and the fish diversion structures in the Columbia River creating a buffet kind of situation. And, of course, in the Delta we have that same sort of situation. In that case it is habitat that has created a situation where predators are able to congregate, the prey are congregated, and predation has a big impact.

But if you do not remove the habitat problem, and you remove all the striped bass, large-mouth bass might be right in there next. And, despite all the comments about the success of pikeminnow removal, everything I read in the testimony presented to me, and the synopsis by the committee, was Columbia River, we removed a lot of pikeminnow. Uh-oh, sea lions. Now stellar sea lions. Now Caspian terns.

This is what I meant in my testimony when I talked about complementary responses. Let's say we remove the striped bass. As I mentioned, there are 24 other potential predatory species in the Delta, and probably an equal number in the Columbia, as my colleague mentioned. So, after having taught resource management for 30-plus years, let me just end my answer by saying sometimes the low-hanging fruit is sour.

Mr. HUFFMAN. Especially when the entire tree is rotten, maybe you should have the bigger conversation. Thank you for your testimony.

Dr. FLEMING. The gentleman yields back. Dr. Gosar is recognized.

Dr. GOSAR. You know, I am just licking my chops over here.

Mr. Grossman, my good friend from California made the comment about canneries at the mouth of a river. Aren't they predators?

Mr. HUFFMAN. That is why we stopped them from doing that.

Dr. GOSAR. That is what I am saying, is——

Dr. GROSSMAN. Yes, we don't do that any more.

Dr. GOSAR. So, my whole application is there is validation on the ultimate predators and all predators combined.

Dr. GROSSMAN. In special circumstances, absolutely.

Dr. GOSAR. Oh, special circumstances, baloney.

Mr. Demko, I am going to go to you. There is no doubt that many of our river systems throughout the country have been changed by water and power infrastructure. Our engineering forefathers deliberately envisioned the need to store and deliver water and harness the power of moving water, among other things. Some believe that altering or removing these facilities is "more productive than predator control." Do you agree?

Mr. DEMKO. No, and let me back up a little bit to say that I am not just anti-striped bass. I am anti-large-mouth bass, I am anti-small-mouth bass. I am anti-non-native fish, because it is shameful that in this day and age that right now the fish biomass is 98 percent non-native. Ninety-eight percent of our fish in the Delta are non-native. Sixty-nine percent of the non-native fish in California were intentionally introduced by the California Department of Fish and Wildlife.

This is our problem, just like the structures that we have in the Delta are a man-made problem. The problem we have is we altered the habitat and then we put in species that actually are better adapted to that altered habitat than our native salmon.

But to think that we were just afraid to try and solve the problem. I actually have people tell me that we cannot remove striped bass because we don't know what will happen, and it is like, really? You think it is going to get worse? I mean 98 percent of the biomass is non-native species. What do you think is going to happen? The system is going to collapse?

I mean I am really for giving this a try, at least spending a decade to remove a lot of the non-native fish. And again, this is free. Few opportunities come our way to have a real meaningful impact that are free, fast, and effective.

Dr. GOSAR. I want to follow up. In your written statement you said that more water does not equal more fish. Some have sug-

gested that flows are the best way to help recover fish. Of course, these flows can be diverted from farms and ranches at times. Based on your statement, what are your thoughts?

Mr. DEMKO. The flow issue is a challenging one, because it is hard, as a biologist, to sit and argue against flow, or against the fact that fish need flow, because, obviously, fish live in water. There is some ground-breaking science for you.

[Laughter.]

Mr. DEMKO. And, I think that the flow equals fish mentality comes from—what we see in the Central Valley, as other places—and this is a poignant point for me, because I see it in the Mekong.

Why is the Mekong such a huge producer of biomass, of fish? It is because in the high flow years you get a lot of shallow-water habitat. And this is what we see in California, as well. In the wet years, the high-flow years, fish are kind of a boom and bust animal. Historically, what you would see—well, even today, in high-flow years temperatures are cool, things are flooded, conditions are good for fish, predators are laid down, so we get good fish production.

Historically, in high-flow years and even medium-flow years, you would still get a lot of shallow-water habitat created, because of the system that we have to protect our cities and our farmland. We have levees throughout the lower rivers and the Delta. What happens when flow goes up in that environment? It is like raising the elevation of water in a bathtub. You are not really making habitat for fish any more. All you are doing is raising the elevation a couple of inches.

And what we see down in the Delta, with high flows within the managed flow range, we can reduce or release a couple of thousand cfs here and there to help fish, it does not change the habitat, it does not reduce temperatures, it does not change turbidity. All the things that we see in those high-flow years, we do not get that from the managed-flow years.

Dr. GOSAR. Well, I am going to make a note. This is something I have a background and a knowledge in, in aquatic environments. What I have seen is that science is, instead of peer-reviewed and outcome-driven objectives, science is what bureaucrats will reward for preconceived outcomes by the Federal funding of specific objectives.

I will give you a perfect example that is non-aquatic: our forest health. This is what is problematic about this. And I appreciate, Mr. Demko, your thoughts and outlines. Thank you.

Dr. FLEMING. The gentleman yields. Mr. Costa.

Mr. COSTA. Thank you very much, Mr. Chairman, for the hearing. I have a lot of questions, some I will have to submit for the record.

But, let's get real here. The world has changed in 100 years in California and on the West Coast. We have the population of folks that have changed and altered the environment. That is the reality. So, when we talk about restoration of fisheries, and we talk about the introduction of non-native species, what world are we trying to re-create?

Are we going to try to go back 100 years? Because I don't think that is feasible. The Sacramento-San Joaquin Delta System does not look anything like it did 100 years ago, to the point that you

made, Mr. Demko, in terms of habitat, when you do have high flows like we have experienced.

But, let's be clear. A choice has been made to take water away from communities that are in dire need, where we have had a zero water allocation, the people I represent, some 4 million people in the San Joaquin Valley, to provide uncertain benefits to species that have been harmed, clearly, for a host of reasons.

And today, we are highlighting the impacts of being eaten by non-native species that humans have introduced, going back to 1879, when we brought in striped bass to the Delta. I think it is, frankly, morally wrong, and it should be drawing national attention, similar to the water crisis in Flint, Michigan.

Einstein once famously said, "If you can't explain it simply, you don't understand it well enough." And the impacts of predation on the recovery of listed species is, I think, a living example of that quote. The fact is that we have a situation here in which, whether it is 20 percent or whether it is 50 percent, we are doing nothing about it.

To your point, Mr. Grossman, habitat, clearly, contaminants, discharges, export of water, and predators are all factors in the decline of these native species. But it is like flying an airplane. We are only using one control to deal with this, and that is the power—i.e. the exports of water. We are ignoring habitat, for the most part, we are ignoring contaminants, we are ignoring predators, and we are ignoring the discharges into the system. How can you have any success in dealing with this, when we are unwilling to acknowledge the other factors?

Mr. Stelle, you have indicated that this is a challenge and it is a problem. Why have we, in every major watershed that the Bureau of Reclamation deals with, U.S. Fish and Wildlife Service, that there is a predator program except in the Central Valley?

Mr. STELLE. Thank you, Congressman Costa. I think the answer to your question is in the Columbia. The target species, the target predators that we are working on, as you have heard, the avian species and the fish species are not managed actively by the state and Fish and Wildlife for purposes of commercial or recreational activities——

Mr. COSTA. I would like you to get back to me on the answer. I only have a minute, and we won't get there.

Mr. STELLE. Yes, OK.

Mr. COSTA. I have offered an amendment that was introduced in Congressman Valadao's bill of last year, the same language included in the discussion draft in Senator Feinstein's bill, that would direct your agency to prepare a plan for the Central Valley to begin initiating a pilot program for predation. Would you support that?

Mr. STELLE. Yes, sir.

Mr. COSTA. OK. And, you believe it is necessary, as a part of one of the management tools, to deal with this issue. Is that correct?

Mr. STELLE. Yes, sir.

Mr. COSTA. What specific steps has NMFS taken to reduce the predation effects in this species?

Mr. STELLE. We are implementing a pilot program, we, the Department of Fish and Wildlife, to target predation hot spots——

Mr. COSTA. Which we saw up here on the video.

Mr. STELLE. Yes.

Mr. COSTA. Do you believe that spring and winter-run Chinook salmon can be recovered and de-listed without addressing predation of non-native black bass and striped bass?

Mr. STELLE. I believe we should address all major limiting factors, including predation.

Mr. COSTA. Of course. Common sense would tell you that. But, politically, it is unacceptable. Politically, the thing that we do hear is that we blame a certain region of the state, and we say you can dry up and blow away because, politically, it is not popular to take a certain sports fishing industry and say there is a problem here and we ought to address it. I am just frustrated more than I can tell you of trying to come together with common-sense solutions that deal with all the stress factors.

Clearly, export of water is one of them. No one denies that. But when we have waters of the rivers running in these El Niño storms at 50,000 cubic feet per second, and we reduce exports to minus 2,500, something is not correct. It does not make any sense. We are saying one part of the region of the state can do without water—we don't say that to fish—while the rest of the state can have water. It is not fair, it is unacceptable.

My time has run out, Mr. Chairman, but I will submit the other questions for the record. Thank you.

Dr. FLEMING. The gentleman yields back. Mrs. Lummis, you are recognized.

Mrs. LUMMIS. Thank you, Mr. Chairman, and thank you, witnesses, for being here.

Mr. McCormack, did I hear you say that since the Marine Mammal Protection Act passed, that sea lions have increased six-fold? I see Mr. Stelle shaking his head in agreement. You agree with that.

Before the Marine Mammals Act, who or what was predating on sea lions? What was keeping their population down?

Mr. MCCORMACK. The sea lion population? Is that your question?

Mrs. LUMMIS. Yes. Because, presumably, the law has protected them from something, causing their numbers to go up.

Mr. MCCORMACK. Sure.

Mrs. LUMMIS. OK. So before the Act, was it humans that were keeping their numbers down?

Mr. MCCORMACK. The California sea lion is not native to that region.

Mrs. LUMMIS. So, how did they get there?

Mr. MCCORMACK. I think it is just the migratory pattern of the sea lion. And, I think it was mentioned before, when they find an easy area to catch fish, they migrate to that area. And, of course, they benefit from the buffet, I think, is how it was explained earlier.

Mrs. LUMMIS. So, following up, Mr. McCormack, there is a section 120 of NEPA, correct?

Mr. MCCORMACK. Yes.

Mrs. LUMMIS. And that would allow for some taking of sea lions to help reduce their numbers so the salmonids have an opportunity to mature. Correct?

Mr. MCCORMACK. Correct.

Mrs. LUMMIS. Now, you were awarded an exemption under section 120, is that correct?

Mr. MCCORMACK. No, ma'am. We were not awarded any exemption under 120. I think it was actually the treaty aspect of it. The treaty right was removed from tribes for lethal removal of sea lions as a treaty right to help protect those fish. However, we do believe that as tribes, that we should have that same equal opportunity. And that was with the legislation that was introduced by Ms. Herrera Beutler, that would give the tribes that ability to be considered as states, or to be part of that permitting process.

Mrs. LUMMIS. Oh, OK, thanks. That is helpful to me. What has caused delays? Why would it be helpful to have a NEPA exemption? What has caused the delays?

Mr. MCCORMACK. I think, we have talked about this being such a man-manipulated system, we are seeing a crisis, and we are seeing a huge impact on salmon.

And, with the NEPA process it has been very public. The public has had a tremendous amount of input, has had tremendous amounts of dialog in this process thus far. So, we feel that the science, the data, the information exists already, and we feel that we have presented the best science already, that allows us to be able to allow for that NEPA exemption for this part of the process.

Mrs. LUMMIS. Mr. Stelle, how do you feel about the science that Mr. McCormack just discussed. Are you confident in the science he just described?

Mr. STELLE. Yes, particularly as it relates to sea lion predation. We have good quantitative data on rates of predation by sea lions.

On section 120 of the Marine Mammal Protection Act and the authority to lethally remove, we have some specific ideas about how that authority can be strengthened. It is cumbersome, and it is targeted at individuals. It creates a big evidentiary burden to be able to set up the ability to remove an individual. So, we think that re-shifting it away from problem individuals to populations is a better scoped program.

On the issue of NEPA, ma'am, as a general proposition, our folks who have been implementing this program believe that the NEPA process, rounded, has actually been a help. And it has been a help because it has been the venue within which we can have an engaged public discussion about how to address sea lions. They have unequivocally said that that engaged public discussion strengthened the ability to implement the program.

Mrs. LUMMIS. Mr. McCormack, one more question. Has litigation played a role in any of the delays here?

Mr. MCCORMACK. Absolutely. Nature does not wait for court, you know. It has a tendency to continue to move forward, regardless of what we feel we need to do. So, litigation has had impacts on the delay. Of course, the fish are going to continue to be impacted while we are in court. So, absolutely, litigation does have an impact.

Mrs. LUMMIS. My time has expired. Again, thank you all. I yield back.

Dr. FLEMING. The gentlelady yields back. Mr. Lowenthal, you are recognized.

Dr. LOWENTHAL. Thank you, Mr. Chair, and I thank the witnesses. For me, in southern California, this is a great learning experience.

Let me just ask. I know you have already said this, but just to kind of understand where we go from here. I will start with Dr. Grossman. In your testimony, you clearly explain some of the ecological factors that are affecting salmon population, both kind of top-down things, such as predation we talked about, and fishing pressures, but also other factors, such as water contamination, water temperatures, stream architecture, and flow.

So, the question I have is what the science really says. If we implemented policies—let's say we took one aspect of that, which we are here today talking about, predation, and we greatly reduced sea lion, striped bass, cormorant populations, we just decreased those. Do we have any way of predicting or understanding, knowing certainly what the impact would be on the salmon population? And, if we are going to really have a more aggressive predation issue, what are we really missing at that point? Or really, does the science say that it potentially could be anything, with limited resources, where do we go from here?

Dr. GROSSMAN. Thank you, Congressman. I would like to start by echoing one of Mr. Stelle's original comments, which is that management has to be based on science.

Dr. LOWENTHAL. Yes.

Dr. GROSSMAN. And the gold standard for science is peer review. We have heard a lot of comments about this report, and that report, and so on and so forth. I don't know of very many peer-reviewed scientific articles that deal with predator control around the world that show that in natural systems predators really limit a species. It is only in these cases where habitat has been so messed up that the predators can congregate.

In the Delta, for example, we have dams, all sorts of things that affect flow, that actually send salmon smolts into what we would call a death zone, to use kind of a sound byte. They send them into a part of the Delta where they cannot find their way down to the ocean. And, of course, that is where these exotic predators are, they are just waiting for these fish.

Let me clarify one other point, since it has been implied repeatedly that I am opposed to predator control. I am not opposed to predator control if it is set up in a controlled, scientific manner so that, in the end, we can actually evaluate its effectiveness.

Dr. LOWENTHAL. Evaluate the impact.

Dr. GROSSMAN. However, if you asked me based on what I know about the Sacramento-San Joaquin Valley, if you ask me 10 years from now will the millions of dollars that we will spend on predator control, if that will have a really significant impact on salmon abundance, I would say no.

Also, what has been mentioned here are the declines in salmon, the bad years of 2008, 2009. NMFS agrees that those declines in the salmon population were caused by oceanic conditions, not by anything that happened in fresh water systems.

So, to reiterate, I would love to see a predator control study that was well controlled so that, at the end of the day, we could, as citizens, say this money that we spent was justified or it was not

justified. But if you ask me my opinion about where I would rather see the limited amount of funds we have spent, I would rather see them on habitat improvements and alterations to structures that divert fish.

And there was a comment about Bonneville Dam. In the South Sacramento Valley, where the water export facilities are, there is an area called Clifton Court Forebay. When I had the hearing in 2013 on fish predation in the Delta and I was up there, somebody from the audience yelled out, "It's Clifton Food Court." And that is an apt description of the situation that some of these structural alterations produce.

Now, I am not saying—with all due respect to Mr. Costa—I am not saying we should stop all water exports or anything like that. I am just saying we need to identify what the root causes are of these problems. That is the only way to ensure that our management funds are being spent in a cost-effective manner——

Dr. LOWENTHAL. Thank you. I am almost out of time.

Dr. GROSSMAN. Sorry.

Dr. LOWENTHAL. I know Mr. Demko wants to comment on this.

Mr. DEMKO. Yes.

Dr. LOWENTHAL. I hope that you will have enough time to respond. But briefly.

Mr. DEMKO. Well, this is interesting, and I don't know if I can do it briefly. What if I told you that mortality is not just a Delta problem. What if I told you the mortality of out-migrating juvenile Chinook was 100 percent in some of our tributaries? Would that get me 5 minutes on the clock so I can elaborate?

Dr. LOWENTHAL. Well, maybe if we have another round. No, Mr. Fleming is not going to give you——

Mr. DEMKO. I was hoping to entice you with that one. But we did a FERC study in 2012 which required a lot of different parties, all the agencies, a lot of different individuals got together to plan this study.

This was in the Tuolumne River. We had upstream and downstream estimates of juvenile Chinook abundance. And what we found is 96 percent loss, 96 percent loss at the same time we were evaluating predator populations, pumping stomachs. And all of that lost, I believe, can be explained by predation. And this is in the Tuolumne River, where we do not have levees, we do not have—there are some, but it is a much more natural environment than we have in the Delta. So, this is not just a Delta problem, this is a tributary problem.

In the Stanislaus River in 2015, 100 percent of the fish that came back were hatchery fish. We do not have a hatchery on the Stanislaus River. So, the only way you get all hatchery fish coming back is if none of your natural fish survived during out-migration a few years prior.

Dr. LOWENTHAL. I thank you. There is a signal I hear in the background. Hopefully it is not——

Dr. FLEMING. Good try again for the 4 minutes.

[Laughter.]

Dr. FLEMING. I have lost total control here——

Mr. DEMKO. I have more.

Dr. FLEMING [continuing]. So I have to regain it somehow.

Dr. LOWENTHAL. Thank you, Mr. Chair. I yield back my time and everyone else's.

[Laughter.]

Dr. FLEMING. Yes, thank you, Mr. Lowenthal.

Mr. LaMalfa.

Mr. LAMALFA. Thank you, Mr. Chairman. I will try to steal back some time from southern California, as well.

It is a pleasure to have the panel here today. Mr. Demko, from my neighborhood, so glad you could make it out here. Of course, your work on the Sacramento River and the Central Valley Project, and some of the clients you have worked for, really gives you much, much credibility in this area. So I appreciate your time.

Part of what you stated in your testimony here—and I may have you elaborate on that tributary business a little bit more, too, but we are getting back to this predator issue in the Delta here. We have figures that show somewhere between 97, 98 percent of the smolts are being consumed by predators. We are getting down to where we have 2 or 3 percent left that we can somehow manage with high flows, extra flows of water here.

One of the examples was a pulse flow of about 80,000 acre-feet in another situation. I mean, we are coming back to the prevailing thought that man-made infrastructure is bad, and we should just rip everything out, put it all back to where it was, and all water would flow out to the sea. That is what we ultimately are ending up with here.

So, there is not much acknowledgment that the storage of water has made for this 4 years of drought the ability to release water, no matter what its temperature, no matter what amount you are releasing, to keep fish flows going and fish species, maybe not in perfect condition, but manageable until we get through the drought. There is not much acknowledgment that the man-made infrastructure has helped with that. It is always that is what is wrong with everything.

Mr. Demko, please elaborate on the impact of the predators versus the amount of additional pulses we are doing, what is the ratio of success?

Mr. DEMKO. Well, it is interesting, and this gets back to the flow question from earlier. I can say that in all my years of doing this, if there is one thing that could have been proven, if there was one thing that the government could have proved, it is that more flow equals more fish. And when I am talking about flow, I am talking about within the managed flow range, not in those high, wet flow years.

But in all the studies that have been done over the years, I have seen nothing convincing that tells me that 1,000, 2,000, or 3,000 cfs during spring time increases the survival of the juveniles migrating out of the stream. So, I am just not a big fan, because I do not see those pulse flows being effective. And still, even if they were effective at moving fish downstream, you still have the downstream Delta problems. The mortality is also really high, and a couple of thousand cfs in the Delta is literally a drop in the bucket.

Mr. LAMALFA. Thank you. We have heard that a lack of data from Mr. Grossman—Mr. Stelle, also—that we do not have the data on knowing what might happen if we somehow had a big re-

duction of the striped bass or some of the other predators that we have in this system or others. We don't know. We do not have the data.

I would like to know, Mr. Stelle, what is the data that says 2.5 billion gallons of water released—urging the Bureau to do that down Clear Creek, how do you get that number? Two-and-a-half billion gallons, by my rough math, is about 8,000 acre-feet, which would be enough to handle the needs of about 16,000 homes per year, and who knows how many crop acres. An arbitrary number.

Where does that number come from? Hey, we are just going to have you release 2.5 billion gallons of water for this particular flow. What is the recovery? What is the payoff for releasing that much water without a lot of data?

Mr. STELLE. Thank you, Congressman. I cannot answer specifically to the release you are referring to.

Mr. LAMALFA. OK, any other large flow. Do you ask for a pulse of——

Mr. STELLE. Yes.

Mr. LAMALFA. A couple cases, 15,000 acre-feet.

Mr. STELLE. Yes.

Mr. LAMALFA. How are these numbers derived, that this is the right amount, with those waters flowing past other needs that people have, agriculture has——

Mr. STELLE. The pulse flows are designed to move juveniles out of the system, down the river systems and into the Delta. So we typically——

Mr. LAMALFA. What data is it based upon before it is decided to use that amount of water to do that? How much research, how much NEPA work has been done to decide this is the amount of water we should release during a drought year, water you would not normally have without the infrastructure that was built to contain it?

Mr. STELLE. We use hydrological models that look at existing flows and the ability to increase existing flows above a certain baseline in order to trigger fish movement out. And then——

Mr. LAMALFA. Filling the bathtub an extra few inches, such as Mr. Demko talked about, was going to have a positive effect?

Mr. STELLE. Yes, it is really not volume, it is flow. It is velocity. It is speed and velocity that the juveniles will follow.

Mr. LAMALFA. And who derived these models?

Mr. STELLE. These are both Bureau and NOAA models.

Mr. LAMALFA. And have they been peer-reviewed by anybody else besides internally?

Mr. STELLE. Yes. Oh, yes.

Mr. LAMALFA. And there is agreement by other water users that these are scientifically sound?

Mr. STELLE. No, I would not say that there is an agreement on the pulse flows, sir. Not at all.

Mr. LAMALFA. I still have another minute of southern California time, Mr. Chairman. Just kidding.

[Laughter.]

Mr. LAMALFA. Thank you.

Dr. FLEMING. Like I said, I have lost control today. I thank the gentleman. The Chair now recognizes Mr. Denham.

Mr. DENHAM. Thank you, Mr. Chairman. Mr. Stelle, last July we held a hearing on predation. At that time, NOAA informed our office that there were no programs in California addressing predation and removing the non-native fish out of our area.

I think you could hear from Mr. Costa's concern—not concern, frustration. We are pissed off. We have people that are out of jobs. It is affecting our entire community. And it feels like the Administration continues to ignore the fact we are struggling through a record drought. I think most of California believes that we have a high snowpack, that we have high water flows coming in, high precipitation, and that this 4- or 5-year drought is somehow going to be over.

Yet, last month, we pushed out 200,000 acre-feet of water in pulse flows, without addressing predation, which, by your numbers, is 97 percent. We have seen other numbers at 98 percent. We are losing the endangered species that the Administration says we are trying to protect. But at what cost?

Last month, we released 200,000 acre-feet of water. That is 70,000 acres of farmland that will go fallow this year. That is 1,500 jobs that will be lost. In my community, that is 400,000 families, enough water for an entire year for 400,000 families.

Mr. LaMalfa just asked about the science behind it. There has not been any science behind pulse flows. There have not been any reports coming out of your office that show that it is actually helping to save the population. I mean the question that Mr. Costa asked is, 10 years from now are we going to have this issue resolved, are we going to suddenly have more salmon in our area, are we no longer going to have this on the endangered species list? My prediction is no, it will still be on the endangered species list, we will just have less farmland and less people employed in our area.

This Administration continues to talk about social justice. Where is the social justice in our area with the high unemployment, with communities that are being devastated, with the bread lines? This is no longer just a farming issue. This is no longer an issue between northern California and southern California. This is a national issue in the bread basket of the world, where lives are being damaged, and people are losing jobs. And we have yet to see anything coming out of your office to address predation in our area. How would you answer that?

Mr. STELLE. A couple of responses, Congressman. First of all, you and your staff have been very constructive in helping fashion a non-federally funded predator control program in the drought legislation pending now, and we appreciate that, and we stand ready to work with you on implementing it.

Second, we are, in fact, in the middle of pilot programs to look at predation hot spots, tag fish, and try to quantify the effectiveness of eliminating or reducing those hot spots. So we are, in fact, trying to implement a pilot program for control and reduction of predation, coupled with monitoring, so that we can generate the data, so we can make the case to expand the program. So, we are in the process, more work needs to be done.

Mr. DENHAM. I can appreciate the ongoing discussions between your office and mine. They have been productive conversations. But my frustration goes with the Administration.

We have had several different bills coming out of this committee now. Jamie Herrera Beutler had a bill. I have had a bill on predation. There was a bill on a pilot program dealing with—there is one on CVPIA dealing with the dual fish-doubling goals, as you mentioned. We have a ratepayer-financed one dealing with predation. Why does the Administration continue to come out and oppose each of these issues that are actually addressed with sound science?

If our goal is really to protect these fish, fish over the people in our community, then shouldn't we at least have the programs in place, the legislation supported by the Administration?

My question is how do we get the Administration to actually hear our message coming out of this committee, that this is an issue? And if we are going to address the endangered species, then we have to address some policies. We would expect them to work with us on those policies, especially when we are dealing with social justice in our community.

I think we are out of time, but if you could carry that message back, and I will follow up with some questions in writing, as well.

Mr. STELLE. I will do so, sir.

Mr. DENHAM. Thank you. I yield back.

Dr. FLEMING. OK, the gentleman yields. Mr. Newhouse. You are recognized.

Mr. NEWHOUSE. Thank you, Mr. Chairman. I appreciate all the panel members here, talking about this important subject. Judging from the last questioner, this is costing us a lot of money, but a lot more than just ratepayer or taxpayer dollars. It is costing a lot of people's futures, as well. So it is an important topic, and I appreciate everybody's input here this morning.

Mr. McCormack, Commissioner, I wanted to ask you a couple questions. Hatchery use has been something that has been prevalent for a long time. Some criticize hatcheries, others think they are a vital source for fish. Your organization has really been on the cutting edge of hatcheries in the Pacific Northwest, and we appreciate that very much.

Could you describe for us what has been done in our region to expand the value of hatchery fish?

Mr. MCCORMACK. Absolutely, thank you. I think, again, it has been very contentious. And I think as tribes, there is always a conflict sometimes when you are dealing with nature versus manipulation. Again, I want to recognize that we tribes have always supported trying to be as natural as possible, but also recognize the cards that we have been dealt and the cards that lay on the table right now that we have to deal with and we cannot ignore.

I think that is where the hatcheries come into play. We have had tremendous success, because of the dams. We built hatcheries, and we have had to do that because of the dams, to mitigate for the loss of those salmon. As a fisherman myself, there is great spiritual significance to the things that we do, and that is the effort that we put into it. It is not something that we do because it makes us money, it is something that we do because it is a part of our being, it is a part of the way we live our life. That is the effort that we put into it.

So, when we have explored these hatcheries, trying to find new methods and cutting-edge ways, and trying to increase those salm-

on numbers, it is for the bringing back of those fish. And, we have numerous, numerous success stories that I think would take all day to go through, but I think those efforts are necessary right now. Hatcheries are necessary for our part of the region, in order to continue to live the way of life that we have brought upon ourselves.

Mr. NEWHOUSE. Thank you, I appreciate that. There are several pieces of legislation. One is H.R. 564, which is the Endangered Salmon and Fisheries Predation Prevention Act, which I have co-sponsored. It attempts to amend the Marine Mammal Protection Act to allow Pacific Northwest states, as well as tribal authorities, to engage and participate in sea lion population management, which you are familiar with.

In light of what we are talking about today, do you think that protections under the MMPA have caused an ecosystem imbalance?

Mr. MCCORMACK. I would not say that is the fault. I would not blame that. I think there are a lot of factors in that. We can use it as a management tool, again, looking at what we are dealing with, and looking at the system that we have to deal with.

The imbalance is there, and we have to deal with that imbalance. That is our burden that we have brought upon ourselves. And I think that is the reason for it.

Mr. NEWHOUSE. Mr. Demko, in central Washington and the Pacific Northwest, through our hydro-electric dams, public power utilities spend hundreds of millions of dollars a year on fish passage and efforts to conserve salmon. In your opinion, can these conservation efforts be successful if we do not have an effective predation program?

Mr. DEMKO. I think predation is so significant, considering the system that we have in California, the highly altered system that we have, all of the challenges that we have. I think, without doing something to reduce predation, it is really just a lost cause. I think we are just throwing money at a problem, and we are not going to get anywhere with it.

Mr. NEWHOUSE. Again, I appreciate everybody's contribution to this very, very important issue. Like I said, millions of dollars are spent annually on this, and we need to get it right. So, we look forward to continuing to work with all of you on that.

Thank you, Mr. Chairman. I yield back my time.

Dr. FLEMING. The gentleman yields back. Panel, we are not going to do another formal round, but I will open up the dais for those who may want to ask one additional question.

Mr. Costa, do you have a question?

Mr. COSTA. Yes, Mr. Chairman. I am informed that—I don't know if it is correct—that this week is National Invasive Species Week. I don't know if that is the purpose or the reason that we have had this hearing today. But my question is to Mr. Grossman and Mr. Demko. I think we have all acknowledged that we have altered the natural habitat, not just of the Sacramento-San Joaquin Valley, but you go up the river systems of the Northwest, to the Columbia. I mean it is not the same place it was 100 years ago. And we have climate change, and we have to deal with that.

When we dealt with the silvery minnow problem in New Mexico, part of the solution to deal with that was to create, as I understand

it, with the University of New Mexico, a hatchery program to propagate the silvery minnow. Is that correct, Mr. Stelle? You are nodding your head, yes.

So, I am wondering. As we deal with the turbidity issue and the difficulty in monitoring smelt, which are the feeder fish, obviously, for the salmonid species, as well as, I guess striped bass like them really well, too——

Mr. STELLE. Everybody like smelt.

Mr. COSTA. Everybody likes smelt. OK, good.

[Laughter.]

Mr. COSTA. Would it not make any sense acknowledging that we have an altered state here to deal with part of that problem, in terms of feeder fish for these species we are trying to protect, to propagate for the biologists here—smelt, as we have done in other circumstances? Does that make any sense?

Dr. GROSSMAN. There is an experimental hatchery which provides fish for scientific research in the South Delta for Delta smelt.

Mr. COSTA. I know that, I am aware of it. But they obviously could produce a lot of Delta smelt that would deal with at least the issue of providing a feeder fish for the salmonid.

Dr. GROSSMAN. Yes. So, as Doug said, and as a review of the literature indicates, the majority of predators in the Delta, the majority of fish in the Delta are invasive species. The majority of prey of invasive predators are also invasive species. The problem with salmon and smelt is that they have been knocked down to such low levels that even a little bit of predation might affect their populations.

Hatchery practices, in terms of restoration of fish populations, have been a mixed success. So they are typically——

Mr. COSTA. No, and I think that is acknowledged.

Dr. GROSSMAN. OK.

Mr. COSTA. Mr. Demko, do you want to opine?

Mr. DEMKO. Interesting, because it has been said recently that you can total—with hatchery production of juvenile salmonids and juvenile salmon and natural production, we are probably talking about 35 to 40 million fish. It has been said that that represents 1 percent of the striped bass diet in a given year, which tells you the extent of the problem.

So, stripers and all of the other non-natives are obviously out there, preying on salmon, preying on other fish. But most of what they are eating has to be other non-native fish, because that is what is in the system. So, I don't think there is any solution to finding an alternate food source or moving them, which I have heard people talking about.

I sure think that hot spots—and it has become quite the key word these days, or a buzz word—10 years ago it was quite different. Definitely, this is again——

Mr. COSTA. We have all those fish finders so we can now know where those hot spots are.

Mr. DEMKO. Yes. We should change, we should fix those hot spots. But fixing the hot spots is not going to solve the problem, because striped bass—and I was taught in college that they are only in the system for spawning. And the water holders in the Stanislaus River, who have been funding for over 10 years now,

were the first ones to document the migration of striped bass in the San Joaquin Basin and realize that they actually live in the system year-round, and they actually live fairly far upstream in cold water year-round.

So, striped—they are not located at certain hot spots, or structures, or diversions. They are just living within the river. So, these striped bass are fish that have become highly adaptable.

Mr. COSTA. Do they have a predator?

Mr. DEMKO. Sport fishermen.

[Laughter.]

Mr. DEMKO. It is the only one that comes to mind. And we are kind of restricting them. We have good restrictions on sport fishermen, which I am all for lifting, by the way, if you haven't noticed.

Seals, I guess seals are another one. But other than that, I would say no.

Mr. COSTA. Thank you, Mr. Chairman.

Dr. FLEMING. OK, thank you. And Mr. Denham?

Mr. DENHAM. Thank you, Mr. Chairman. Mr. Stelle, again I want to re-emphasize the great working relationship we have had. We have had an ongoing discussion between our offices, and I will continue to work on predation legislation as we move water bills forward, and hopefully get the Administration's positive report back on that.

But right now, NMFS has the funding and the ability to put a predation program in place today, do you not, without current legislation?

Mr. STELLE. To put the program that your legislation describes in place? Is that the question, sir?

Mr. DENHAM. Yes.

Mr. STELLE. Let me not speculate, but frankly, I have been wondering that exact question myself. If this is a good idea and we have a funding source that is willing to participate in it, what are we waiting for?

So, let me, if I may, sir, circle back to you in a formal way and answer that question of can we proceed with your program, independent of legislation, and just get on with it. I would be happy to jump on that.

On the other issue of——

Mr. DENHAM. You can study whatever you want, though, under your current purview?

Mr. STELLE. Oh, yes, absolutely.

Mr. DENHAM. If you could get back to me on the predation piece.

Mr. STELLE. Yes, I will.

Mr. DENHAM. Our legislation is meant to force you to do it. We would rather see you do it on your own, especially with the science being there. And we would like to see that done as——

Mr. STELLE. I will get back to you promptly.

Mr. DENHAM. OK.

Mr. STELLE. And stay engaged.

Mr. DENHAM. Thank you.

Dr. FLEMING. OK, the gentleman yields. Mr. Huffman, do you have a question. OK, Mr. Huffman is recognized.

Mr. HUFFMAN. Thank you, Mr. Chairman. I appreciate this conversation. I hope that it is clear that, at least from my perspective,

and I think the Democratic perspective in general, nobody is saying do not go and look at predation. Nobody is saying do not experiment, do not try some new things. I think what I and others are saying as well though is have the right expectations. Don't expect this to solve the problem.

So, Mr. Stelle, my understanding is that the scientific community has kind of taken that approach. They are willing to look at this, but many have concluded that in a system as complex as the Delta, where you are not talking about a single defined channel on the lower Columbia River below Bonneville Dam, where you can sort of manage the predators right there, you are talking about a system of interconnected sloughs and tributaries and anabranched channels, that controlling one part of it for one period of time is going to be pretty transitory, and may not solve the problem. So, the expectation that this is going to deliver us from endangered status on any of our salmon runs is probably not very realistic.

I wanted to ask you, though, about this idea that flows maybe do not matter, because we have sort of heard allusions to that once more. I think we do have some data and some scientific consensus that even this predation problem goes way down when flows go up. Could you comment on that?

Mr. STELLE. Yes. We have litigated around the issue of flow regimes, minimum flow requirements, pulse flows. And we have prevailed in that litigation. There are extensive peer reviews of the hydrological models that we use, and the correlations that we have established between different flow regimes, different water years, productivity, and salmonid population productivity. I would be happy to provide the committee with a synopsis of some of that scientific work. We are not making this up at all.

The difficulty is getting quite precise in your quantification. So, why do you choose four, and not five, or three? And the choice of target flows and a particular target is very difficult to justify, as compared to something—one unit above or one unit below. But as a practical matter, you need targets to manage operations.

Mr. HUFFMAN. Thank you. I yield—yes, please.

Mr. DENHAM. You know, the ongoing question is, if this is something that will help, why wouldn't everybody want to look at it. But it is the state government that is holding this up.

In FERC re-licensing for our area, you have to study this area. But it is Fish and Wildlife that is the one that is saying, "No, we are not going to study it." So——

Mr. HUFFMAN. The Stanislaus, is it?

Mr. DENHAM. Yes, for TID and MID, the two irrigation districts in my district that want to move forward, that need to study it, just for FERC re-licensing, let alone actually going the next step and actually saving fish and saving water. It is the State Fish and Wildlife that is saying no.

Mr. HUFFMAN. Well, again, I do not have any problem with studying it. I think there is probably a lot of broad support for continuing to study it. But the 95 percent loss, the 97 percent loss in winter run that we have had these last few years, that was not predation. All the successful predation pilots in the world would not have saved any of those juvenile fish. And all of the evidence

seems to suggest that there are much bigger stressors at work on these salmon populations than just predation.

So, I think it is just important that we keep the bigger context, as we explore it.

Dr. FLEMING. OK. The gentlemen yield back, and we are done with our questions today.

I would like to thank our witnesses for their valuable testimony. Members of the subcommittee may have additional questions for witnesses, and we ask for you to respond to those in writing. The hearing record will be open for 10 business days to receive those responses. If there is no further business, the committee stands adjourned.

[Whereupon, at 11:43 a.m., the subcommittee was adjourned.]

[ADDITIONAL MATERIALS SUBMITTED FOR THE RECORD]

PREPARED STATEMENT OF U.S. FISH AND WILDLIFE SERVICE, U.S. DEPARTMENT OF THE INTERIOR

Thank you for providing the Department of the Interior the opportunity to submit this statement for today's hearing. It is our understanding that the subcommittee is interested in the intersection between the Migratory Bird Treaty Act (MBTA) and the Endangered Species Act (ESA), as they relate to the protection and recovery of endangered salmon in the North Pacific. This statement describes the U.S. Fish and Wildlife Service's (Service's) role in the Federal management of double-crested cormorants and Caspian terns, as required by the 2008 and 2014 Federal Columbia River Power System Supplemental Biological Opinions (BiOPs) for endangered salmon. This statement also provides an update on those management efforts.

ENDANGERED SPECIES ACT

Under Section 7(a)(2) of the ESA, all Federal agencies must ensure that any action they authorize, fund or carry out is not likely to jeopardize the continued existence of a listed species or result in the destruction or adverse modification of designated critical habitat. If the Federal agency determines that an action may affect a listed species, then either formal or informal consultation with the Service or the National Marine Fisheries Service (NMFS) is appropriate. If a listed species will be adversely affected either directly or indirectly due to the Federal action, then the Service or NMFS prepares a biological opinion (BiOp) that includes a review of scientific information considered and a detailed discussion of the effects of the action on the listed species or designated critical habitat in the action area. If the proposed action is not likely to jeopardize the continued existence of a listed species, but incidental take is anticipated to be likely, then reasonable and prudent measures are included to minimize the impact of the incidental take. If the action is likely to jeopardize a listed species or adversely modify designated critical habitat, then reasonable and prudent alternatives are identified during consultation that can be implemented in a manner consistent with the intended action, are economically and technically feasible, and would avoid the likelihood of jeopardy for species or adverse modification for critical habitat.

The action agency is responsible for initiating the Section 7 consultation process by contacting either the Service or NMFS, depending on the ESA-listed species involved. The Service has responsibility for terrestrial, freshwater, and certain marine listed species and anadromous fish, including bulltrout and sturgeon, as well as sea otters, and manatees. NMFS is responsible for implementing the ESA Section 7 consultation for all other marine and anadromous fish species that are listed under the ESA.

The 2014 BiOp [1] and the 2008 BiOp,[2] prepared by NMFS, in cooperation with the Service and the Action Agencies (U.S. Army Corps of Engineers, Bonneville Power Administration, and Bureau of Reclamation), comprehensively review the salmon lifecycle and require actions to address an array of factors that affect salmon survival and recovery, including operations at the dams in the FCRPS to improve juve-

[1] http://www.westcoast.fisheries.noaa.gov/publications/hydropower/fcrps/2014_supplemental_fcrps_biop_final.

[2] https://www.salmonrecovery.gov/Files/BiologicalOpinions/2008/2008%20BiOp.pdf.

nile and adult passage, estuary and tributary habitat improvements, and predator management. In both BiOps, NMFS has identified the management of avian predators as an important component of the overall program to improve the status of listed salmonid species. They specifically address the impacts of predation on listed salmonid species from double-crested cormorants, Caspian terns, and other bird species.

MIGRATORY BIRD TREATY ACT

The Service is responsible for implementing and enforcing protections for native bird species under the MBTA (16 U.S.C. 703–711). Double-crested cormorants (*Phalacrocorax auritus*) and Caspian terns (*Sterna caspia*) are among 1,027 species protected under the MBTA, which was first enacted in 1918 to implement a treaty signed in 1916 between the United States and Great Britain (for Canada) for the conservation of birds that migrate between the two nations. The United States went on to become a party to three similar treaties with Mexico, Japan, and Russia. Each migratory bird treaty contains a prohibition against "take" of protected birds, which under the MBTA includes killing, capture, sale, trade, barter, pursuit and other activities (16 U.S.C. 703). Each treaty has a list of species that the parties have agreed to protect through the treaty provisions. The MBTA has been amended by Congress periodically to ensure that this statute fully and faithfully implements United States obligations under all four of these treaties. Cormorants and terns are protected under a 1972 amendment to the 1936 United States-Mexico migratory bird treaty entitled the Convention for the Protection of Migratory Birds and Game Mammals.[3] Under the MBTA, take is prohibited without a permit from the Secretary of the Interior (or designee), but no permit is required to harass or disturb protected birds, unless (1) the species is listed as threatened or endangered, (2) the species involved are bald or golden eagles, or (3) the harassment or disturbance will result in take.

To reduce avian predation on juvenile salmon, the 2008 BiOp calls for the U.S. Army Corps of Engineers (Corps) to develop and implement a Caspian Term Management Plan, and the 2014 BiOp calls for the Corps to develop and implement a Double-Crested Cormorant Management Plan. The 2014 BiOp calls for the monitoring of predation on endangered salmonids by cormorants, terns and gulls.

DOUBLE-CRESTED CORMORANT MANAGEMENT PLAN

The 2008 BiOp did not single out the impact of cormorant predation on juvenile endangered salmonids. However, one of the assumptions in the 2008 BiOp analysis was that specific rates of predation on juvenile endangered salmon estimated for the Base Period would remain unchanged into the future. Instead, the double-crested cormorant (DCCO) nesting population and predation rates increased substantially during 2003–2009. As a result, the productivity of interior Columbia basin steelhead populations was about 3.6 percent lower than assumed for the Current Period in the 2008 BiOp analysis, and that of interior Columbia basin stream-type spring- and summer-run Chinook salmon and ocean-type SR fall Chinook salmon was about 1.1 percent lower than assumed.

The 2014 BiOp, therefore, indicates that reduction of the DCCO nesting population in the Columbia River Estuary is necessary to address mortality of juvenile salmonids by migratory birds. The RPA to address this impact on juvenile endangered salmon requires the reduction of the DCCO nesting colony on East Sand Island to no more than 5,380 to 5,939 nesting pairs, in order to reduce their predation on juvenile salmonids in the estuary. In 2014, there were an estimated 12,150 DCCO nests on East Sand Island. The Corps is responsible for implementing this requirement.

The Corps prepared a DCCO Management Plan that proposes to reduce nesting cormorants on East Sand Island by 13.5 percent over 4 years, which would mean removal of approximately 11,000 cormorants in total. The Corps then applied for and received a depredation permit from the Service for calendar year 2015, authorizing the take of 3,489 DCCO and 5,879 DCCO nests through January 31, 2016. Per Federal regulations, a depredation permit for migratory birds may be in effect for a maximum of 1 year. The Corps will apply for renewal of its depredation permit each year as described in the DCCO Management Plan.

In issuing this and all MBTA depredation permits, the Service ensures that the requested action is consistent with the requirements of the MBTA and that the requested action is likely to provide short-term relief from bird damage. Specifically, in issuing this type of permit, the Service ensures that the action: (1) meets the per-

[3] https://www.fws.gov/le/pdf/MigBirdTreatyMexico.pdf.

mit issuance requirements and criteria (*See* 50 CFR § 13.21), including that the action does not potentially threaten a wildlife or plant population (*See* 50 CPR § 13.21(b)(4)); (2) is consistent with the Federal depredation permit regulation (50 CPR § 21.41); and (3) is compatible with the conservation of the migratory bird species as required by the MBTA. The DCCO depredation permit that was issued to the Corps is based on the recommendations of the final DCCO Management Plan, for which the Corps completed a Final Environmental Impact Statement (FEIS) in 2015.[4] The Service was a cooperating agency on the FEIS. The FEIS evaluates a range of alternatives to reduce cormorant predation on juvenile salmonids and considers a number of different scientific analyses. The 2015 Cormorant FEIS presents the scientific analyses that were considered in preparing these alternatives.

For example, the FEIS took into consideration research funded by the Corps on the potential impacts associated with cormorant consumption of juvenile salmonids in the Columbia River Estuary as early as 1997. This research included monitoring of the size, productivity, and diet of DCCO nesting colonies in the estuary, including on East Sand Island. Other studies considered in the FEIS were conducted in 2004 on non-lethal management techniques, including habitat enhancement, methods to attract cormorants to habitat outside the Columbia River Estuary, and methods to dissuade cormorants from nesting on East Sand Island. In addition, development of management objectives for the cormorant colony at East Sand Island relied on the smolt survival gap (the difference between cormorant predation on juvenile salmonids between the base period (1983–2002) and the current period (2003–2009)).

The 2014 BiOp also thoroughly addresses the issue of compensatory mortality. The idea of compensatory predation mortality argues that at least some portion of the fish consumed by predators would have died from other factors subsequent to the predation event. As stated in the 2014 BiOp, regardless of the magnitude of compensatory mortality associated with cormorant predation in the Columbia River, there is no evidence that it has changed over time. Therefore, if the cormorant population is reduced to its level during the Base Period (between 5,380 and 5,939 pairs), as described in the RPA, the impact of cormorant predation on salmonid survival (including any compensatory effects) should return to the same level that occurred during the Base Period. For the FEIS, new analyses were conducted to understand the environmental factors influencing predation by cormorants on salmon and steelhead. The 2014 BiOp also evaluated the significance of juvenile salmonid survival as a component of the salmon lifecycle. It was determined that reducing avian predation would help to improve safe passage for juvenile endangered salmonids through the Columbia River Estuary.

Our understanding is that the Corps will continue to implement its DCCO Management Plan, as described in Chapter 5 of the 2015 Cormorant FEIS. Chapter 5 of the FEIS proposes annual take levels, which would allow the Corps to meet the 2018 targets in the 2014 BiOp. These numbers are proposals only and will be adjusted accordingly through annual review by an Adaptive Management Team that is comprised of representatives from the Corps, the Service, NMFS, USDA Animal and Plant Health Inspection Service (APHIS), and state and tribal entities.

The Corps' depredation permit expired on January 31, 2016. As of October 28, 2015, 2,346 individual cormorants have been culled and 5,089 nests have been oiled. In 2015, the Corps did not cull the total number of birds authorized under the 2015 depredation permit due to the late start of management activities. The Corps has submitted a permit renewal request to the Service for authorization of the proposed depredation permit activities in 2016, and it is currently under review.

CASPIAN TERN MANAGEMENT PLAN

The potential impact of nesting Caspian terns on East Sand Island on juvenile salmonids was recognized long before the 2008 BiOp called for the Corps to develop and implement a Caspian Tern Management Plan. The Service, in cooperation with NMFS and the Corps, completed the Caspian Tern Management to Reduce Predation of Juvenile Salmonids in the Columbia River Estuary FEIS[5] in 2005, which describes and evaluates four alternatives for reducing Caspian tern predation on juvenile salmonids in the Columbia River Estuary, in compliance with the terms of a Settlement Agreement pertaining to tern and salmon management in the estuary.

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[4] http://www.nwp.usace.army.mil/Media/Announcements/tabid/1887/Article/565600/final-eis-double-crested-cormorant-management-plan-to-reduce-predation-of-juven.aspx.

[5] https://www.fws.gov/pacific/migratorybirds/pdf/Caspian_Tern_Final_EIS.pdf.

Under the Preferred Alternative, nesting habitat for the Caspian tern would be redistributed away from East Sand Island to other locations throughout the Pacific Coast region. This redistribution would be achieved by creating new or enhancing existing tern nesting habitat in Washington, Oregon (outside the Columbia River Basin), and California and ultimately reducing the tern nesting site on East Sand Island to about 1 to 1.5 acres. To ensure a suitable network of sites is available for terns on a regional scale, the FEIS proposed to replace twice the amount of nesting habitat that was being used by the terns and would be lost on East Sand Island. Since terns nested on an average of 4.4 acres on East Sand Island from 2001 to 2004, approximately 6 to 7 acres of replacement habitat were needed to replace the loss of nesting habitat on East Sand Island. This FEIS was used to describe information available on the impact of Caspian terns on juvenile salmonids, and it anticipated the RPA that would be undertaken would be pursuant to the FEIS' Preferred Alternative. Through an adaptive management process, the plan was updated in 2015[6] and the acreage prepared for tern nesting on East Sand Island was reduced to 1.0 acres.

To date, 11 alternative nesting habitat islands totaling 8.18 acres of available habitat have been constructed/enhanced at interior and coastal locations. Tern nesting habitat on East Sand Island has been reduced from 6 acres to 1.0 acre, which has reduced the colony from a pre-management level of about 9,000 pairs to 6,240 pairs. The last reduction of available habitat on East Sand Island was completed prior to the 2015 breeding season. This occurred simultaneous to the full dissuasion of the tern colonies on Goose and Crescent Island colonies that are inland in the Columbia River Basin. Due to the need for terns to relocate to available habitat, it may take several more years to reach the 3,125–4,375 breeding pair goal and the associated reduction of juvenile salmonid predation expressed in the 2005 Caspian Tern FEIS.

At the time of completion of the 2014 BiOp, only Caspian terns nesting on Goose Island in Potholes Reservoir and Crescent Island in the Columbia River were slated for management action (e.g. reductions in habitat). Survival benefits to Upper Columbia River steelhead and spring Chinook are expected to increase since nesting dissuasion actions began in early 2014 on Goose Island. Additional benefits to Upper Columbia and Snake River juvenile salmonids should follow now that both alternative tern habitat has been developed outside the Columbia River Basin and nesting dissuasion actions have been in full force at Crescent Island since early 2015.

The 2014 BiOp reports that the impacts of Caspian terns and other birds, such as gulls and pelicans, are largely addressed in the RPAs of the 2008 BiOp.

CONCLUSION

The Federal agencies remain committed to working together to implement the 2014 BiOp and the full complement of actions described in it to reduce avian mortality on juvenile endangered salmonids in the Columbia River. We are focused on the needs of listed species, as required under the ESA, as well as the United States' obligations to conserve migratory birds under the MBTA in compliance with our international treaty obligations. Due care and diligence, quality information, and continued collaboration with all affected jurisdictions will continue as the 2014 BiOp enters its second year of implementation, and beyond.

[6] http://www.nwp.usace.army.mil/portals/24/docs/announcements/fonsi/final_cate_fonsi.pdf.